Life History of Mosquitoes.

Most mosquitoes lay their eggs on the surface of the water, either singly or in raft-like masses which float upon the surface. On hatching, each larva drops into the water and during its larval existence swims about with a jerky motion, most of the time holding its head downward. It has a large head with a tube or siphon at the tail, and every two minutes or so it comes to the surface and inhales some fresh air through this siphon. It feeds upon the minute particles of organic matter in the water, from six days to three weeks, depending upon the temperature, when it

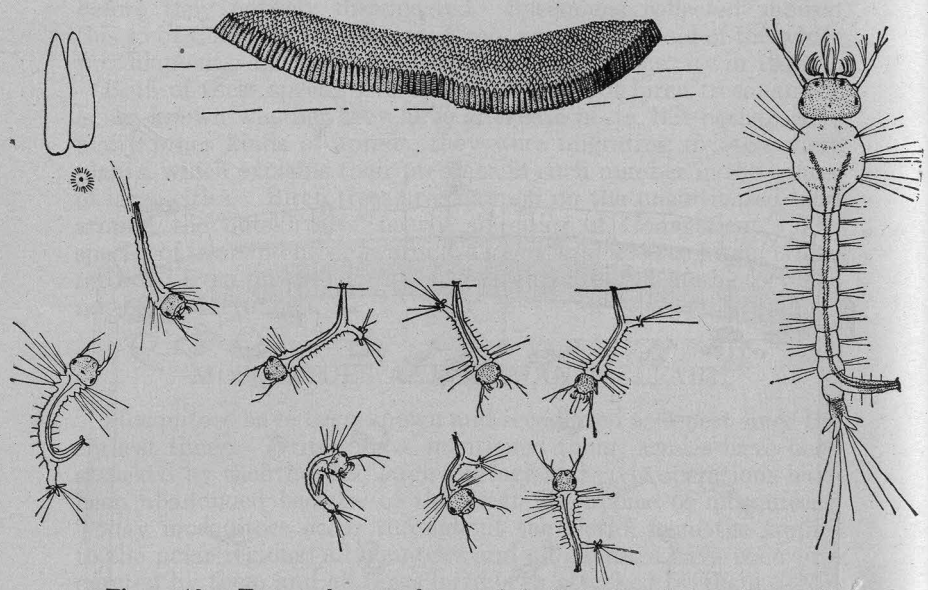

Figure 12. Eggs and young larvae of the house or rain barrel mosquito, *Culex pipiens*, Linn. All enlarged. (After Howard, Bulletin 25, Bureau of Entomology, U. S. Department of Agriculture.)

transforms to a peculiar hunchback pupa. Breathing is now done through two siphons on the thorax instead of one at the tail. In about two days the skin cracks open along the back, and the adult winged mosquito emerges, and after resting on the old shell and drying its wings, soon flies away. Only about a week is necessary for a mosquito to develop from egg to adult in hot weather. The stages in the life of a mosquito are (1) egg; (2) larva; (3) pupa; (4) adult.

Flight of Mosquitoes.

With the exception of the salt marsh mosquitoes, a few hundred feet is the extent of the distance traveled by most mosquitoes.

Salt marsh mosquitoes (two species) migrate or are wind-borne for many miles. In New Jersey they have been found at least thirty miles from their breeding place, and in Connecticut eighteen miles. During strong winds they seek shelter, but in warm foggy weather, gentle breezes may aid them in going inland for several miles. After obtaining blood, they return to the salt marsh to deposit their eggs.

Where intensive breeding takes place in polluted streams, the

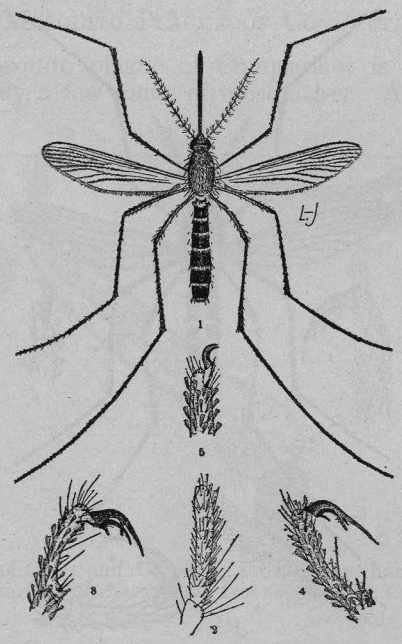

Figure 13. The house or rain-barrel mosquito, *Culex pipiens* Linn.: 1. adult female; 2. palpus; 3. anterior, 4. middle, 5. posterior claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

house mosquito has been found a mile from its breeding place, but usually this species does not go more than one-fourth that distance.

Different Kinds of Mosquitoes.

There are known to be about 500 different kinds of mosquitoes throughout the world; about 100 kinds occur in the United States. Nearly 50 species have been recorded from the State of New York, and about 25 kinds occur in Connecticut. Of this number, only five kinds need here be considered.

RAIN BARREL OR HOUSE MOSQUITO 1. *Culex pipiens* SPOTTED OR MALARIAL MOSQUITO (2 species) 2. *Anopheles punctipennis* 3. *Anopheles quadrimaculatus*	Breed in fresh water; fly only short distances; enter houses and bite after dark.
SALT MARSH OR MIGRATORY MOSQUITOES 4. Brown salt marsh mosquito, *Aedes cantator* 5. White-banded salt marsh mosquito, *Aedes sollicitans*	Breed in brackish water; fly long distances; do not enter houses, and bite promptly in the day time.

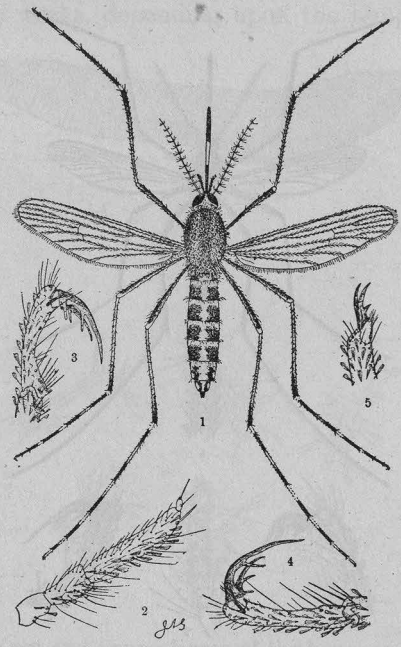

Figure 14. The banded salt marsh mosquito, *Culex sollicitans* Walk.: 1. adult female; 2. palpus; 3. anterior, 4. median and 5. posterior claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

How to Distinguish Malarial from Other Mosquitoes.

Malarial mosquitoes have spotted wings, the beak and body are nearly in a straight line, and it "stands on its head".

Other mosquitoes do not have spotted wings, the beak makes a greater angle with the axis of the body and the body is parallel with the surface upon which the mosquito stands or rests.

Larvae or wrigglers in the water may also be distinguished by their different shapes. Malarial species are green or gray, lie horizontally at the surface of the water, and move to other positions on the surface without dropping downward into the water. Moreover their bodies are nearly as thick at the tail as through the head and the breathing tube or siphon is very short. Other mosquito larvae hold their heads downward when breathing at the surface and if disturbed drop downward into the water. The head and thorax are large, from which the body tapers toward the tail end, which is furnished with a long siphon. The color is usually dirty white or gray.

The Mosquito Plague of Connecticut.

The great mosquito plague of Connecticut is caused by the abundance of only a few kinds of mosquitoes. A few years ago

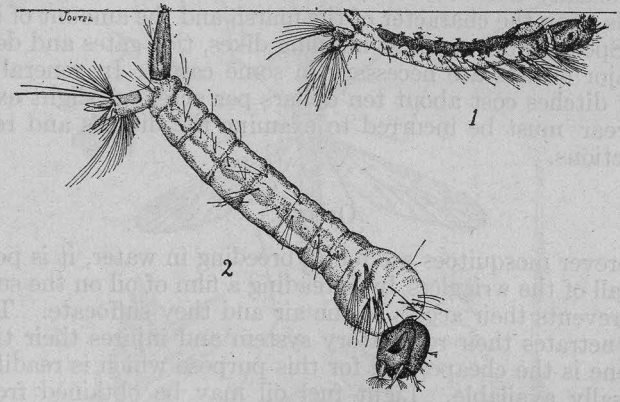

Figure 15. Larvae of *Culex* and *Anopheles*, showing the characteristic position of each at the surface of the water. 1. *Anopheles;* 2. *Culex cantator.*

in the southern half of the State, the salt marsh mosquitoes were the most prominent, and this is true today except in certain sections where the salt marshes have been ditched. In these ditched sections and in all other parts of the State, the rain barrel or house mosquito is the chief offender.

At present about one-third of all the salt marsh areas of Connecticut have been ditched and the ditches have been maintained in working condition. There still remains some 12,000 to 14,000 acres of salt marsh to be ditched before we shall be rid of the nuisance of migratory or day-biting mosquitoes.

The rain barrel mosquito is local in its distribution and breeds in rain water pools, receptacles, polluted streams, etc. A single bucket of water will furnish enough mosquitoes to infest the premises.

Control or Relief Measures.

Rain Barrel Mosquitoes.—Fill or drain all depressions which may catch or hold water during the summer months. See that no receptacles collect and hold rain water about the premises. Small swamp areas and deep depressions which cannot be filled or drained except at great expense, may be dredged to form permanent pools and stocked with fish.

Malarial Mosquitoes.—See that edges of springs and streams are cleared of vegetation and have steep banks. Screen all houses, and particularly all persons having malaria.

Salt Marsh Mosquitoes.—Cut narrow parallel ditches through the salt marsh, from the hard land to the central creek or outlet. These usually need to be about 150 feet apart, but the distance depends upon the character of the marsh and the amount of breeding. Special work, such as building dikes, tide gates and deepening major outlets are necessary in some cases. In general these narrow ditches cost about ten dollars per acre. A slight expense each year must be incurred to examine the ditches and remove obstructions.

Oiling.

Wherever mosquitoes are found breeding in water, it is possible to kill all of the wrigglers by spreading a film of oil on the surface. This prevents their access to the air and they suffocate. The oil also penetrates their respiratory system and injures their tissues. Kerosene is the cheapest oil for this purpose which is readily and universally available. Light fuel oil may be obtained from oil stations in the larger cities. Old cylinder oil from garages may be used if mixed with an equal quantity of kerosene. A spray pump is the common agency for spreading the oil, though in small pools a sprinkling can or saturated sawdust may be used. One fluid ounce of kerosene will cover about 15 square feet of surface.

Oiling is only a temporary expedient and should not be practiced except in special cases. On the salt marsh in a single season it would cost about one-fourth as much to oil the pools as it would to cut ditches, but the ditches would last for years and make further oiling unnecessary.

Mosquito Enemies.

Fish feed upon mosquito wrigglers, particularly small fish such as "minnows" and "killies" which eat animal food and feed near the surface. By cleaning the banks of deep pools and sluggish streams, and stocking with these fish no mosquitoes will breed there. There are also many aquatic insects which devour mosquito larvae.

Individual and Community Effort.

The control of the fresh water species like the malarial and rain barrel mosquitoes which fly only short distances, is a matter for each individual resident and property owner, though far more will be accomplished if all individuals work together toward the same end. This is largely a problem of house to house inspection, with control measures practiced where needed.

It is a commendable line of activity for local civic and village improvement associations, boy and girl scouts and women's clubs

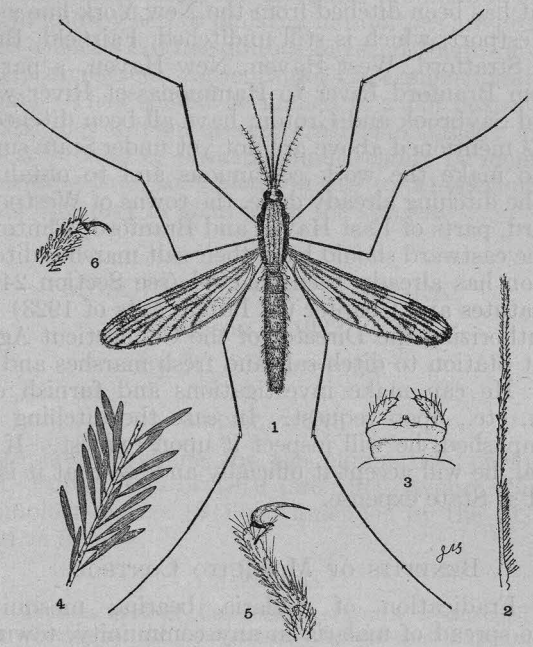

Figure 16. A malarial mosquito, *Anopheles punctipennis*. 1. adult female; 2. palpus; 3. genitalia; 4. part of wing vein, showing scales; 5. anterior, and 6. middle claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

to co-operate with the Experiment Station. Surveys can be made in each neighborhood to ascertain where mosquitoes are breeding. When mosquitoes are especially troublesome, specimens should be collected and sent to the Station for identification. There is already legislation (Section 2408 of the Revised Statutes) declaring accumulations of water in which mosquitoes breed a public nuisance, and authorizing the health officer to order them abolished.

Salt Marsh Mosquito Problem A State-Wide Matter.

As the mosquitoes of the salt marsh are migratory and often fly long distances, isolated individual or even community effort counts for but little in controlling the plague. Even efforts involving entire townships, though commendable, do not bring the maximum degree of relief unless other towns also act in the matter. Some towns will take no action, either on account of cost or because the people do not expect effective results. Consequently when left entirely to local initiative, the work is apt to be spotted and disconnected if any is done at all. Thus the salt marsh area of Connecticut has been ditched from the New York line as far eastward as Westport, which is still unditched, Fairfield, Bridgeport, a part of Stratford, West Haven, New Haven, a part of East Haven, from Branford River to Hammonasset River with small areas in Old Saybrook and Groton, have all been ditched. Some of the areas mentioned above are not yet under State supervision. In order to make the work continuous and to obtain the full benefit of the ditching already done, the towns of Westport, Stratford, Milford, parts of East Haven and Branford, Clinton, and all towns to the eastward should have their salt marshes ditched.

Legislation has already been enacted (see Section 2409 of the Revised Statutes and Chapter 68, Public Acts of 1923) providing for, and authorizing the Director of the Connecticut Agricultural Experiment Station to ditch salt and fresh marshes and maintain the same. He can make investigations and furnish estimates, supervision, etc., upon request. In case the ditching work has been accomplished, he will inspect it upon request. If it merits his approval, he will accept it officially and see that it is properly maintained at State expense.

Benefits of Mosquito Control.

Health.—Eradication of malaria bearing mosquitoes will prevent the spread of malaria in any community, town or state. Other native species of mosquitoes, though not known to carry disease-causing organisms, are a detriment to health because their bites sometimes become infected, and because of the irritating effect on the nervous system.

Comfort.—No person can be comfortable when attacked by hordes of mosquitoes. Whole regions have been developed, neglected or abandoned because of the absence or abundance of mosquitoes.

Increased Property Values.—Wherever the mosquito nuisance has been controlled, substantial increases in property values have followed. This is a logical result of making building sites more desirable because people can be more comfortable there. The increased population means increased business, increased transportation, and better yet, increased taxes for the town and for the State.

Increased Crops.—Wherever salt or fresh marshes are ditched the quality of the vegetation is improved; it makes better hay. The quantity is also increased, giving a greater yield. It has been shown in New Jersey that by ditching the yield of salt marsh hay has been increased from two to twenty fold.

Send Specimens For Identification.

If anyone is interested in the mosquito problem of his locality and wishes to know whether malarial mosquitoes are present, he is requested to collect adult mosquitoes and send them for identification to the Connecticut Agricultural Experiment Station, New Haven, Conn. They should be mailed in a pill box or vial, well packed so that they will not become crushed in transit. Mosquitoes which are badly worn or broken cannot readily be identified, but if the material is fresh and plentiful (10 to 20 specimens) there should be no difficulty in identifying the species.

MOSQUITO CONTROL WORK.

Season of 1923.

By R. C. Botsford.

Legislation.

The State law providing for the elimination of mosquitoes, Chapter 21, Public Acts of 1919 (see 1919 Report, Connecticut State Entomologist, page 194) was amended by the 1923 Legislature to read as follows:

Chapter 68.

Section 1. Section 2409 of the general statutes is amended to read as follows: The director of the Connecticut Agricultural Experiment Station may make rules and orders concerning the elimination of mosquitoes and mosquito breeding places, and he or his agent may enter upon any swamp, marsh or land to ascertain if mosquitoes breed thereon or to survey, drain fill or otherwise treat, or make any excavation or structure necessary to eliminate mosquito breeding on, such land. Whenever funds have been provided by voluntary contribution or by appropriation by the state for the elimination of mosquitoes or mosquito breeding places said director may order the execution of such work upon notice as herein provided. At least thirty days before commencing such work, said director shall file a copy of such order, with a description of the place or area affected and a statement of the proposed plan thereof, in the town clerk's office in each town in which such place or area is located. Said director shall publish a copy of such order once each week for two successive weeks in some newspaper having a circulation in the town or towns in which such place or area is situated, and shall mail a copy of such notice, postage prepaid, by registered mail, addressed to each record owner of land whose name and address may be ascertained by a reasonable inquiry from the assessors of the town in which such land is situated. Said

director may, and upon application of any person affected by such order or plan, within thirty days after such publication, shall, assess damages sustained by the owner of any such land. Such assessment shall be filed by said director with the clerk of the superior court of the county within which the land affected is located, and said clerk shall give notice of such assessment to each such property owner, by mailing to him a copy of such assessment, postage prepaid. Any person claiming to be aggrieved because of such order or proposed plan or such assessment may, within ten days after notice, apply to the superior court in the county in which such land is situated, or any judge thereof, for relief, and said court or such judge may, after notice to said director and parties applying for relief, and hearing thereon, make any proper order concerning such order or proposed plan, or make a reassessment of damages. Said court or judge may view the land claimed to be affected by such order or plan and may take any evidence in his opinion material. The order, plan and assessment as hereinbefore provided for shall be conclusive upon all parties affected thereby, and the state treasurer shall pay to any such owner the damages assessed by said director or by said court or judge, as the case may be, upon certification of the amount by the clerk of said court. The pendency of any application for the assessment of damages shall not prevent or delay the execution of the work for the elimination of mosquitoes or mosquito breeding. Upon the completion, to the satisfaction of said director, of any such work, said director shall certify to the comptroller, with proper vouchers, the amount of such costs, and the comptroller shall draw his order on the treasurer for the payment of the same.

Sec. 2. Section 2410 of the general statutes, as amended by chapter 21 of the public acts of 1919, is amended to read as follows: Whenever any swamp, marsh or other land has been drained to the approval of the director of the Connecticut Agricultural Experiment Station, he shall keep the same in repair and free from obstruction, and construct or repair tide gates or otherwise treat such areas so as to make such work effective. Said director may appoint one or more deputies to supervise the work done under the provisions of this and the preceding section, who may exercise the authority granted to such director. The expenses of said director and said deputies in carrying out the provisions of this and the preceding section shall be paid from funds provided by voluntary contributions or from funds appropriated by the state for such purpose. The comptroller may advance to said director such amounts within the appropriations therefor, as are necessary to meet the current expenses for labor authorized under the provisions of this and the preceding section. Any person obstructing the work of examining, surveying or ditching or otherwise treating such mosquito breeding areas, or obstructing any ditch, canal or drain, or the natural outlet of any marsh forming mosquito breeding areas, shall be fined not more than one hundred dollars or imprisoned not more than ninety days or both.

Approved April 17, 1923.

Under the old law, the cost of maintenance, not to exceed one dollar per acre in any one town, was paid by the State, and the town wherein the work was done reimbursed the State for three-fourths of the amount so expended for maintenance. This added about $2,500.00 to $3,000.00 to the regular appropriation.

The new law, which went into effect on July 1, 1923, provides that the State pay all expense of maintaining drained areas which have been approved by the Director. The sum of $12,000.00 was appropriated for mosquito elimination work during the two-year period from July 1, 1923 to June 30, 1925.

The total expenditure for the year was $8,944.87. Owing to the change in law this year, a detailed account of the above would be too bulky to be included in this report. The Director's Report for 1923 covers the first half of the year, and his 1924 Report will include the remainder.

General Conditions.

Mr. S. T. Sealy, who has served as Deputy in Charge of the work for three years, resigned to take effect March 31, 1923, and Mr. B. H. Walden was placed in charge of this work temporarily. On July 1, 1923, Director Slate appointed the writer Deputy in Charge.

The general spring inspection showed much of the drainage work in poor condition. Many of the culverts at beach outlets were badly damaged and in some cases completely destroyed. The tide gates and dikes were found to be in fair condition, with the exception of the Stony Creek dike, which was badly damaged.

Although it is unlawful for any person to interfere with the free flow of water in any drainage system under State maintenance, the usual number of obstructions in ditches were found, caused by the careless dumping of rubbish, and by farmers and trappers. In many cases the outlets of ditches became clogged by a thick growth of sedge grass. The result is that some sections of the ditch tend to fill with mud, upon which grass takes root, the water is held back upon the marsh and breeding pools form. Thus in one season a neglected ditch may become a source of mosquito breeding.

For recutting ditches, a simple trimming tool was made consisting of two hay knives bolted to a light brace which held the blades in a parallel position the width of a ditch. A longer handle was attached for ease in operating. With this tool (shown on Plate XXI, a) both sides of a grass grown ditch could be trimmed at the same time. Several thousand feet of ditches were reclaimed this fall.

The absence of rain was a factor in preventing marsh pool breeding, although in some localities the continuous high tides offset this advantage. In every case where breeding was discovered, measures were taken to destroy the larvae and make their recurrence impossible.

The success of the anti-mosquito work this season is largely due to individuals, associations and towns contributing money and reporting mosquito infestations, also the co-operation of city departments, town officials, the board of health and others.

The Work By Towns.

NEW HAVEN.

The salt marsh mosquito breeding in this section was confined to an area in the Quinnipiac marsh north of Little River, the tide water being held back in about 80 acres of marsh by stones under Little River bridge at Middletown Avenue. The Bridge Department removed some of the stones and the water was lowered about ten inches. More stones will be removed next year.

No breeding was observed on the West River meadows. The harbor marsh and the ditched sections at Morris Creek were also kept free. Scattered breeding occurred at Fort Hale by reason of grass grown ditches and the high tide gate sill at the moat outlet. Upon request, the Park Department lowered the tide gate sill about seven inches. All of the ditches south of the Fort Hale road were recut this fall.

There was practically no mosquito breeding in other park property this season, although some *Anopheles* (malaria mosquitoes) larvae were discovered in Edgewood Park. The drainage system being installed at Beaver Swamp by the Park Department has eliminated the prolific *Anopheles* breeding there. One pool in that locality breeding *Culex* (house mosquito) was oiled. Many possible breeding places in the city parks have been filled.

WEST HAVEN.

Before work could be started this season a large brood of mosquitoes developed in the Old Field Creek marsh and infested the town. The tide gate at Beach Street was found badly damaged and blocked with a quantity of large stones. A large sand bar beyond the gate had completely closed the outlet to the harbor. The marsh above was flooded and much sewage was present. These conditions were ideal for mosquito breeding. Much labor was expended in this area keeping the outlet open, the tide gate in working order, and cleaning and recutting grass grown and mud filled ditches. In spite of our efforts, which were hampered by lack of funds, some scattered breeding was present throughout the season. The drainage system in the marsh is difficult to maintain on account of the frequent closing of the outlet by shifting sand. This results in the ditches filling with mud which in turn quickly grasses over. The outlet from the gate to the harbor should be deepened about two feet and a sluiceway installed to extend beyond the sand bar. A new tide gate is required and the creek should be dredged from Beach Street to Peck Avenue.

The other marshes in this section were kept free from breeding.

EAST HAVEN.

The two ditched areas of salt marsh in this section under State maintenance, one at Morris Creek and one at Silver Sands east of Caroline Creek, were kept free of mosquito breeding during the whole season. There was considerable breeding in the marsh near West Silver Sands not under State maintenance. These mosquitoes were troublesome periodically throughout the treated as well as the untreated areas.

The Town of East Haven has installed 978 feet of 18-inch corrugated iron pipe in Cosey Beach Avenue, extending from the property of Philip Smith to an extension of Caroline Creek.

The Connecticut Company has completed the filling of its marsh area at Momauguin including the ditch between this property and Philip Smith's which formerly carried the drainage water from a large swamp north of the road leading to South End. Adequate means of handling this water are to be provided by the property owners and connected to the 18 inch pipe laid by the town.

The State Rifle Range was inspected on June 12. Owing to the lack of rain nearly all of the depressions that hold water in an ordinary season were dry, and no mosquito larvae were found. There were many fresh water mosquitoes present which had emerged earlier in the season. These were especially abundant in the wooded or brush areas. In the open spaces many salt marsh mosquitoes were observed which had undoubtedly come from the undrained salt marshes in the southern part of the town.

BRANFORD.

Labor for maintenance of this section was furnished by Mr. L. E. Rice. In some cases mosquitoes got on the wing before the areas could be treated. At Sunset Beach the natural outlet was found to be closed by large rocks which were removed at considerable cost. The Sybil Creek marsh north of the tide gates on the Indian Neck road was covered with water. This situation was partly corrected by lowering the bed of the creek under the road bridge. Many of the ditches in this area were filled with soft mud and grassed over, creating breeding pools on the marsh surface and in ditches. Several thousand feet of ditches were recut and deepened. No breeding was discovered on other marshes in this section.

The large marsh at Stony Creek has been flooded all the season due to a broken dike. Presumably there was some breeding on this marsh which accounts for some complaints of mosquitoes in Stony Creek Center. State funds were insufficient to repair this dike, but the meadow owners and some public spirited summer residents contributed generously and the dike was repaired. The ditches in this marsh are badly damaged, and it is doubtful if they can be reconditioned next spring in time to prevent early breeding. The tide gates at Hubbard's Bridge on the Branford River need repairs.

GUILFORD.

Maintenance work was started promptly in this section by Mr. Frank Blatchley and continued throughout the season. No breeding was discovered and no complaints received.

Several hundred feet of ditches were recut in the vicinity of Shell Beach and a bad leak under the tide gate sill at Great Harbor stopped. The labor was furnished by one of the summer residents. The area of this section is too great to be properly maintained by one man, and some of the ditches have become grass grown and

filled with mud. This condition will produce breeding pools in a wet season.

MADISON.

The only serious outbreak of mosquitoes in this section occurred early at the Hammonasset State Park. These were troublesome periodically throughout the first half of the summer. Oil and labor were furnished by the State Park Commission and millions of larvae in clogged ditches and marsh pools were destroyed. As soon as the offending ditches were cleaned and graded, no further breeding occurred. Plans are under way to carry on a vigorous anti-mosquito campaign at Hammonasset next year in co-operation with the State Park and Forest Commission.

No breeding was discovered in other marsh areas of this section, and no complaints were received. Much additional labor will be required to recondition some of the ditches, which during a normally wet season will no doubt become a source of mosquito breeding.

The most important part of mosquito control work in this section consists of keeping the several beach outlets open. This was accomplished during the entire season by Mr. Russell Bartlett and but little time remained to patrol the marsh sections properly. This section is too large for one man to maintain at this time owing to gradual deterioration of the drainage works.

The culverts at the beach outlets have been damaged or totally destroyed at some previous time by storms. When these are replaced the labor expended in opening these outlets every few days will go far in reconditioning and maintaining the ditches in the potential areas.

WESTBROOK.

This year the Town of Westbrook appropriated $1,000.00 to start mosquito elimination work in this section. This amount has been increased by generous contributions from a few public spirited citizens. The money was turned over to the Connecticut Agricultural Experiment Station, under whose supervision the ditching of the marshes will proceed.

The long search for suitable labor delayed the start of ditching until December 12. Work was begun on December 12 in Rushy Meadow at Middle Beach. In order to remove the surface water from this flooded and soggy area, about 1,770 feet of old ditches were first recut and deepened. The old ditches were not sufficient to remove all of the pools and 756 feet of new ten inch ditches were cut. Later these ditches will be deepened as required. The outlet of this marsh will require the installation of a 100 foot culvert to carry the water beyond the point of moving sand.

On the small marsh east of the property owned by Mr. Thomas Fisk, 441 feet of old ditches were recut and 510 feet of new ditches dug. The creek bed was widened and graded. A culvert will be required here as at Middle Beach. At the athletic field, 681 feet of old ditches were recut and 291 feet of new ditches dug. A total of 5,112 lineal feet of ditching was installed this year, much of which will require deepening to secure proper drainage.

Ditching was begun on the Broad Creek marsh and on the Lewis marsh south of the railroad track. All the new ditches in this section are being cut with hay knives, using a plank ten inches wide as a guide for cutting the sides of the ditch. The sods are pulled out with potato hooks and a satisfactory ditch is obtained after the bottom is graded.

The drainage work of Rushy Meadow and the Fisk marsh will be completed early next season if no further difficulties develop. These two marshes were found to be the most poorly drained salt marsh areas in Westbrook. They will no doubt prove to be the most costly to drain per acre and the most costly to maintain. As soon as the drainage of an area is completed and approved by the Director of the Connecticut Agricultural Experiment Station, the drainage works of that area will be maintained at State expense.

The other Westbrook marshes are dotted with stagnant pools and it is doubtful if much relief from mosquitoes will be afforded by the present expenditure.

OLD SAYBROOK.

A small ditched marsh area at Fenwick under private maintenance was inspected this fall, but owing to the high tide at that time the exact condition of the ditches could not be determined accurately.

GROTON.

The ditched area at Groton Long Point under State maintenance was thoroughly patrolled. On account of the foot bridge over the marsh outlet having been washed away, large stones had been rolled in for crossing. This interfered with the free movement of water and the stones were removed each trip. A road culvert was found closed due to careless dumping of rubbish, and some breeding resulted in the flooded area. Some of the ditches will be recut next season.

FAIRFIELD.

The drained salt marsh areas in this section under State maintenance were kept in good condition throughout the season by Mr. Nicholas Matiuck, with an average crew of two men. Nine hundred gallons of light fuel oil were purchased from the Standard Oil Com-

pany by contract. Breeding places in salt marshes and especially in the fresh water areas which could not be otherwise treated were oiled throughout the season. The breeding of salt marsh mosquitoes has been reduced to a minimum.

The fresh water problem of this section is under the immediate supervision of Dr. V. Havard, Secretary of the Fairfield Improvement Association, with Nicholas Matiuck in charge of the field work.

In 1922, a survey of the fresh water breeding places was made in this section including an estimate of the amount of labor and material required for treatment. Much public interest was aroused and generous contributions were received. During 1922, $1,081.94 was spent by the Association to treat these fresh water areas. All of this fresh water work was instigated and carried out by the Fairfield Improvement Association, to which great credit is due. The oil and the services of Nicholas Matiuck were contributed by the State.

In 1923, the Town of Fairfield appropriated $2,000.00 to carry on the work. The anti-mosquito activities in Fairfield have proven very successful and other towns are recommended to follow its example.

STAMFORD.

The salt marshes in this section were carefully patrolled by Nicholas Matiuck with an average crew of two men. The ditches were kept open and marshes were properly drained the whole season.

The City of Stamford continued its treatment of the fresh water areas.

MISCELLANEOUS INSECT NOTES.

Swarms of Butterflies.—On August 25, specimens of the milkweed or monarch butterfly, *Anosia plexippus* Linn., were received from Mrs. Edw. B. Rogers, Southport, who wrote that these butterflies were extremely abundant and lighted upon maple and other trees. These butterflies often migrate in large numbers and there are several accounts in entomological journals where swarms have passed the night on trees and shrubs.

Giant Water Bug.—On July 19, Mr. Pierrepont B. Foster of Hamden brought to the Station a large aquatic bug which had attacked and killed a gold fish in his pool. This bug was *Lethocerus americanus* Leidy, known as the giant water bug or electric light bug. It is aquatic during its immature stages but when it has reached the adult stage, it often leaves the water and flies about arc lights at night. It is predaceous in all stages.

European House Cricket.—On April 14, specimens were brought to the writer from an apartment house on George Street, New Haven, of the European house cricket, *Gryllus domesticus* Linn. (See Plate XXIII, b). This insect was said to be extremely abundant in the basement of the building. The individuals could be found in the cracks and crevices of the masonry walls and the tenants were greatly disturbed on account of the infestation. After conferring with the writer, the owner made applications of some prepared roach powder with a blower, and reported that the treatment seemed to be successful.

The Birch Leaf Skeletonizer.—This insect has continued to be prevalent and has skeletonized the leaves of gray birch trees throughout the State. Other species of birches were attacked but were not so conspicuously brown as were the gray birches. The injury was about the same in 1923 as in 1922, and is caused by a small moth called the birch leaf skeletonizer, *Bucculatrix canadensisella* Chambers. The life history of this insect has not been completely worked out. It is the larvae feeding upon the leaves which cause the injury, and if choice shade trees are sprayed with lead arsenate late in July or early in August, this injury will be prevented.

Spruce Leaf-Miner.—On May 7, spruce twigs were received from the F. A. Bartlett Tree Expert Company of Stamford, the leaves of which had been mined by the spruce leaf-miner, *Recurvaria piceaella* Kearf. Descriptions and life history notes regarding this species may be found in a paper by W. D. Kearfott in the Journal of the New York Entomological Society, Vol. XI, page 151, 1903. It is said to attack red spruce in the New England States and black spruce in northern New Jersey. The larva is red on dorsal lateral and ventral surfaces, with a dark green patch on the dorsum of each abdominal segment. Head and thoracic shield, pale brown. No remedy is known.

European Pine Shoot Moth in Connecticut.—On November 24, Mr. Filley brought to the laboratory from Ridgefield, some twigs of red or Norway pine, *Pinus resinosa*, which had been deformed and the buds eaten in the manner caused by the European pine shoot moth, *Evetria buoliana* Schiff. No insects were found in this material, but on October 13, twigs of the same species of pine injured in the same manner were received from Tarrytown, N. Y., containing two brown larvae which we were able to identify as *E. buoliana*. The larvae destroy the buds and this induces the lateral shoots to grow, and many of them become curved, twisted and distorted. Though it seems to prefer the red pine here, it also attacks other pines especially the Scotch, white, Austrian and Mugho pines.

The Box Leaf-Miner.—On November 23, specimens of box twigs were received from the Harkness Estate, Waterford, infested with the box leaf-miner, *Monarthropalpus buxi* Labou. The infested leaves were somewhat curled and showed on the upper surface some indications of irregular mines within. On dissecting, the upper epidermis separated easily from the lower and there were many small whitish green maggots between the layers as is shown on Plate XXIII, a. Dr. Garman visited the place a few days later with a view to studying the insect and testing control measures, but the conditions were not quite suitable for this purpose. The remedies recommended are to spray the foliage thoroughly about May 1 with a miscible oil, one part in 20 parts water, to which is added one pint of 40 per cent. nicotine sulphate per each 50 gallons of mixture. This treatment should be repeated about a week later. In Maryland, success was obtained by spraying the foliage at the time the adults emerge, with molasses diluted one part to three parts of water, this mixture entangling the flies as they emerged or before laying eggs.

Apple and Thorn Skeletonizer.—Full information regarding this insect may be found in Bulletin 246 of this Station, issued in June, 1923. During the season of 1923 there has been abundant opportunity for observing the work of this insect, which has now spread over the entire State. Professor A. E. Stene, State Entomologist of Rhode Island, informed the writer that the pest occurs in Rhode Island. The writer observed injury to apple trees beside the highway in going between Westerly and Providence, R. I., on August 16, which be attributed to this insect. At a conference in Boston, Mass., August 17, apple twigs injured by it and collected on the Massachusetts north shore were shown to the writer. Therefore it has spread throughout southern New England in three or four seasons.

The latter part of July during the summer meeting of the Entomologists of the Northeastern United States, which was held in Connecticut, the apple trees between New Haven and Hartford were brown from the feeding of the larvae of the second brood. Certain trees near New Haven, however, were not so seriously injured as in 1922.

Swarms of the Chain-Dotted Geometer.—On the evening of September 27 and for a few nights thereafter, swarms of thin whitish moths gathered around the "white way" lights in the center of New Haven. The attention of the writer was called to the matter by one of the newspapers, and on investigation the insect was found to be the chain-dotted geometer, *Cingilia catenaria* Drury. Smaller numbers of these moths were found during the daytime clinging to lamp posts, the walls of buildings or on the sidewalks. The caterpillars of this moth feed upon the leaves of

bayberry and sweet fern, when abundant, often defoliating these shrubs. They are slender yellowish larvae, with two conspicuous black spots just above each spiracle, and dorsally striped lengthwise with faint narrow lines. When fully grown they are from one and one-half to one and three-fourths inches in length. The pupa is enclosed in a loose net fastened to the leaves. The moth has a wing-spread of about one and one-half inches, is white, with chains of black dots across the wings. Larva, pupa and adult are shown on Plate XXIV.

Flight of Cotton Moths.—On September 12 and 13 there were swarms of cotton moths, *Alabama argillacea* Hubn., in New Haven, Bridgeport, Stamford and doubtless other cities and towns of the State. They fluttered around the stronger lights during the night time and in day time were resting often head downward on the plate glass store windows, walls of buildings and lamp posts. Similar flights have been noted in former years, and in the Report of this Station for 1911, page 339, and for 1912, page 217, are notes regarding the appearance of this moth in Connecticut in those seasons. The moth is a uniform light reddish brown with white discal spots on the fore wings. When resting the wings are folded in the shape of a double roof (Λ) and the moths present a trim and attractive appearance. The caterpillars are known as "cotton worms" in the southern States and are not known to feed on other plants. In some seasons they are extremely numerous in the cotton States, and the adults migrate northward often in enormous numbers and are sometimes reported from many of the northern States and Canada, usually in September and October. This insect is not known to hibernate in the United States, unless possibly in Texas. The adult is shown on Plate XXIV, d.

A Japanese Weevil in Connecticut.—On July 29, 1920, Messrs. Zappe and Walden while inspecting nursery stock in a nursery in New Haven, collected some curious fat brown weevils which were new to the Station collection, and which were unfamiliar to Mr. Zappe. Mr. Zappe collected more of the same species on July 26, 27 and 30, 1921, and on June 24 and July 21 and 27, 1922. Mr. Walden also collected one specimen on July 21, 1922. In 1923, some collecting was done in the vicinity but no specimens of this weevil were obtained. Specimens were sent to Mr. H. C. Fall, who replied that it was probably introduced from some other country. On May 15, 1922, the writer took some specimens to Mr. E. A. Schwarz at the U. S. National Museum, Washington, D. C. Mr. Schwarz stated that the species was not represented in the National Museum and that it might be difficult and take considerable time to identify it. On May 28, 1923, Mr. Zappe took some specimens to the American Museum of Natural History in New York City and left them with Mr. A. J. Mutchler, who said

he would show them to Mr. C. W. Leng and possibly between them they might be able to fix its identity. Not succeeding, Mr. Mutchler afterward sent it to Dr. G. A. K. Marshall of the British Museum, London, who replied in part as follows:

"The insect is, as your information suggested, a Japanese species, *Pseudocneorrhinus setosus* Roelofs. I am not aware, however, that anything has been recorded with regard to its habits or life history. I trust that it has not yet established itself in the United States."

According to the observations of Mr. Zappe, the adults feed upon the leaves of burr marigold, *Bidens* sp. So far we have been unable to obtain any information about the immature stages of this insect. The adult is shown on Plate XXIV, e.

Authorship.

For bibliographical purposes all notes and articles in this Report (Bulletin 256) should be credited to W. E. Britton, except where otherwise indicated.

Illustrations.

The illustrations in this Report (Bulletin 256) are from the following sources: text figures are all from drawings as follows: Fig. 9, map drawn by A. E. Moss, shaded by Stoddard Engraving Company; Fig. 10, drawn by B. H. Walden; Fig. 11 drawn by Philip Garman; Fig. 12 after Howard, Bulletin 25, Bureau of Entomology, U. S. Department of Agriculture; Figs. 13, 14 and 16 after Smith, New Jersey Agricultural Experiment Station; Fig. 15 drawn by L. H. Joutel. The plates are all from photographs from the following sources: XXI, c, and XXII, b, by R. C. Botsford; XI, a, and XIII, by W. E. Britton; XIX, a, XX, c, and XXII, a, by Philip Garman; X, b, by G. H. Hollister; XIV, XV and XVI by J. Leslie Rogers; XVIII, a, by Bureau of Entomology, U. S. Department of Agriculture; all others by B. H. Walden.

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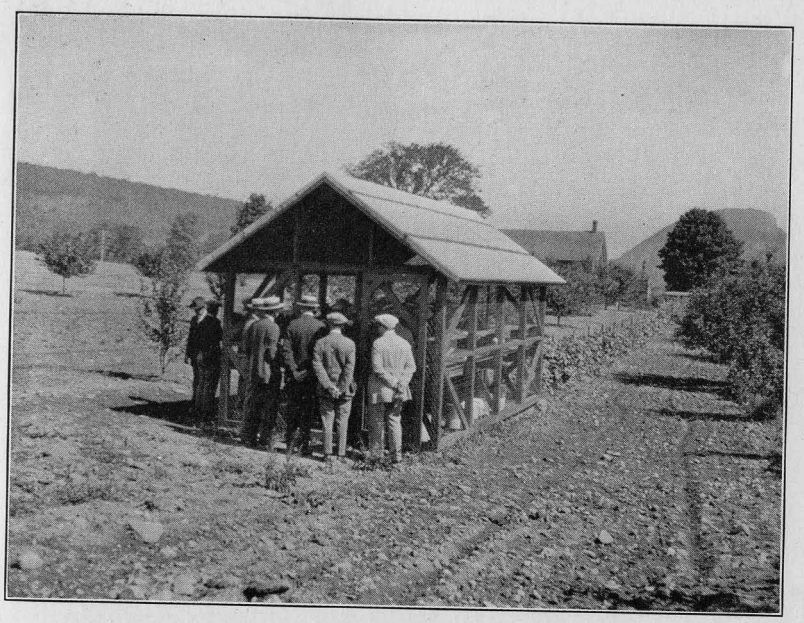
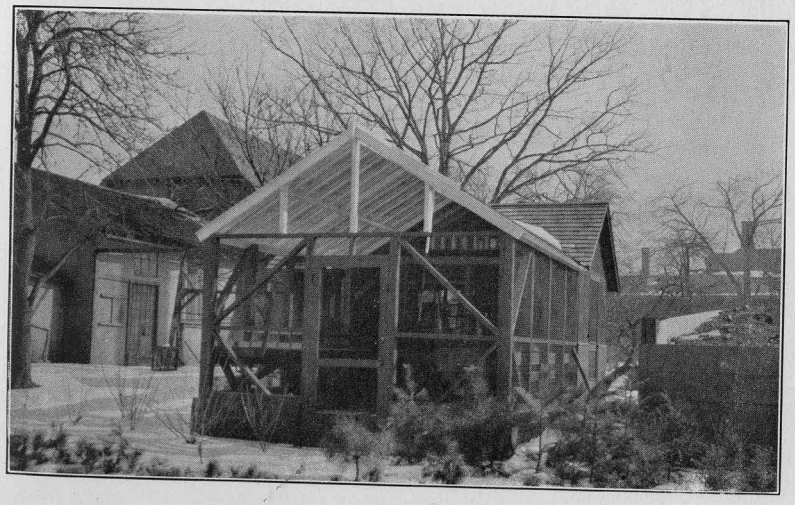


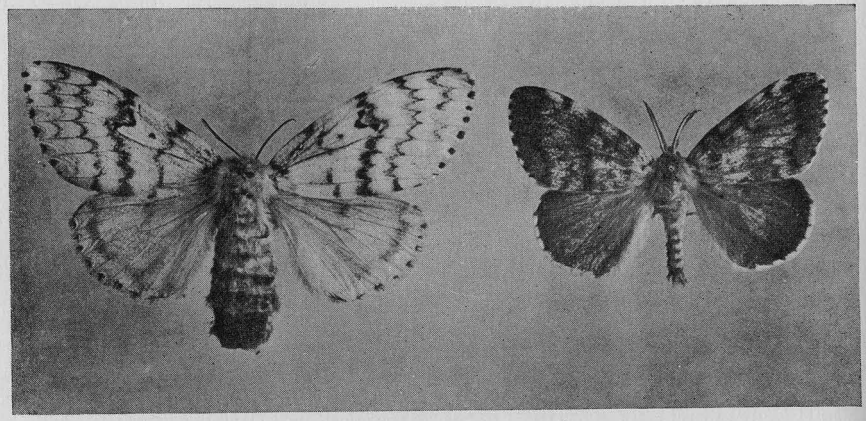
a. Field insectary at Station Farm, Mount Carmel, at the time of the Entomologists' field meeting.



b. Enlarged insectary at Station.

NEW EQUIPMENT.

PLATE X.

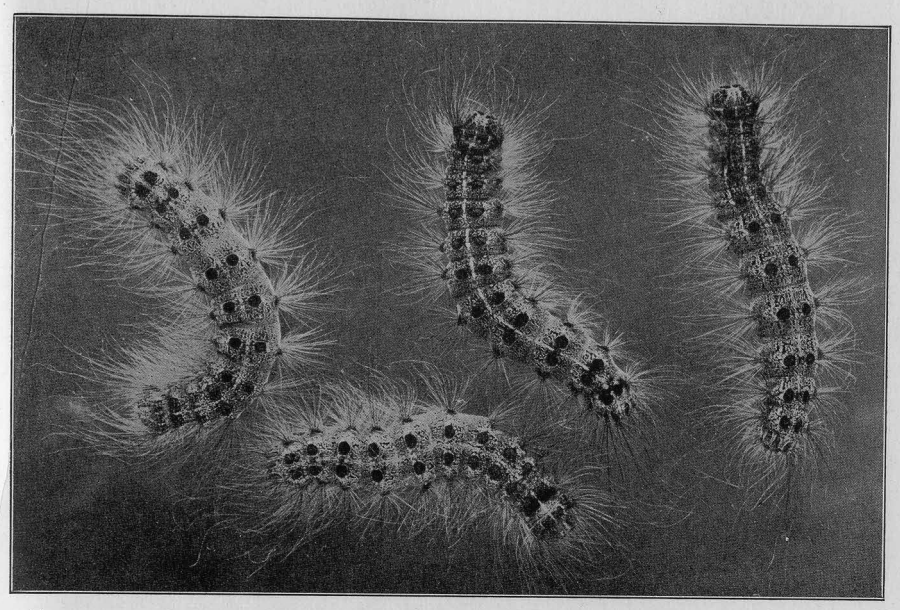


a. Female and male gipsy moths. Natural size.

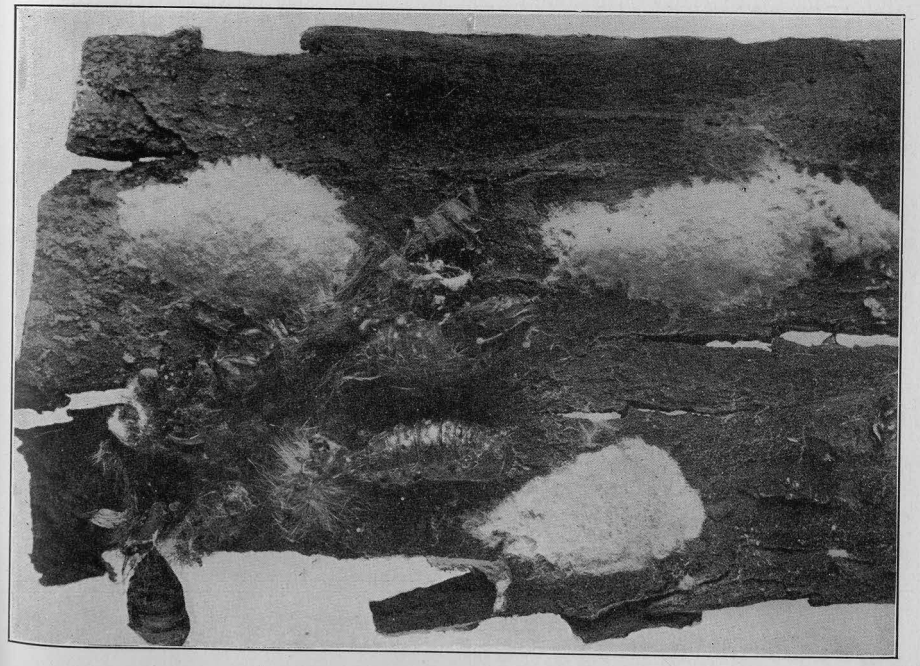
b. Treating an egg-mass with creosote.

GIPSY MOTH CONTROL WORK.

PLATE XI.



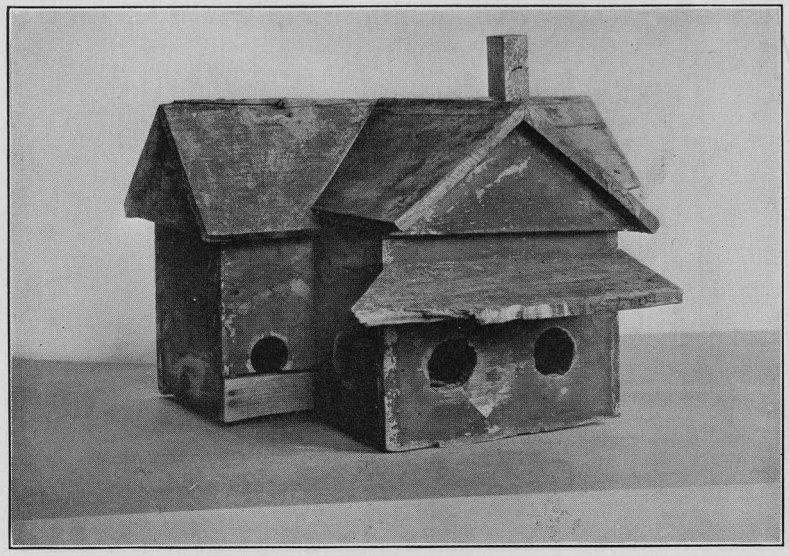
a. Gipsy moth caterpillars. Natural size.



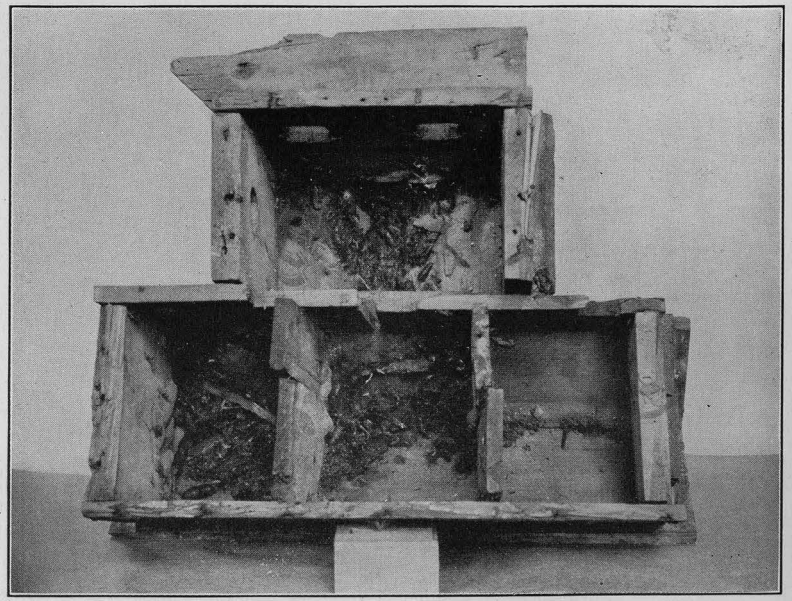
b. Egg-clusters and pupae on inside of loose hickory bark.

GIPSY MOTH CONTROL WORK.

PLATE XII.



a. An innocent looking bird house.

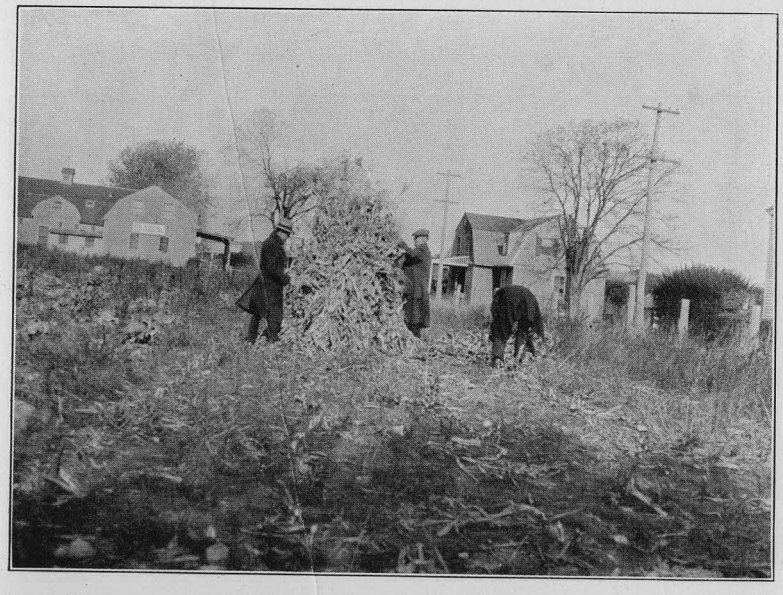


b. Inside of the bird house containing about 107 cocoons and 35 egg-masses.

GIPSY MOTH CONTROL WORK.

PLATE XIII.

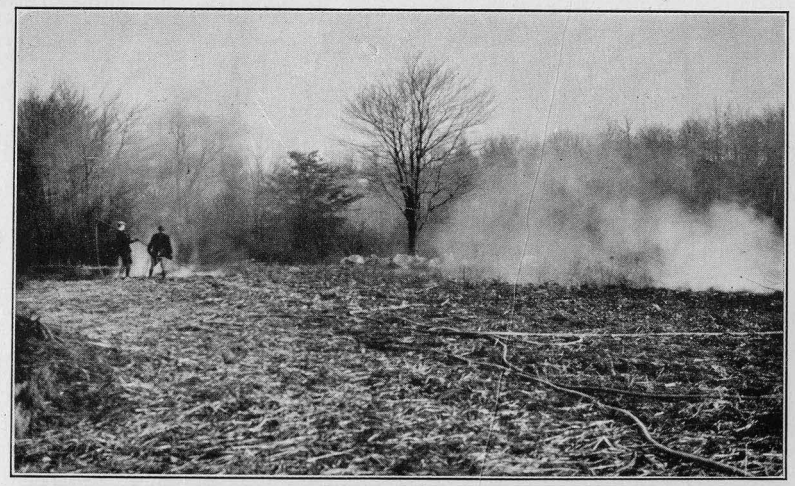
a. View in garden where first infestation was found in Connecticut, Groton, November 10.



b. Another view in same garden.

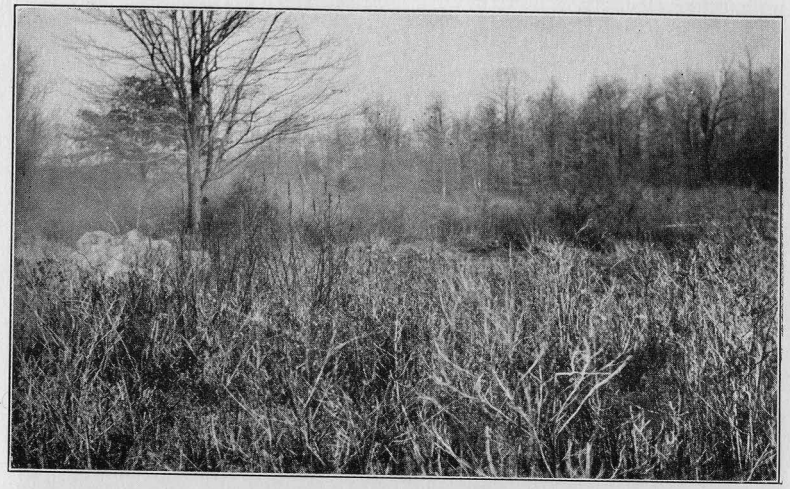
EUROPEAN CORN BORER.

a. Burning weeds and rubbish with Federal burning truck, infestation No. 1, Groton.

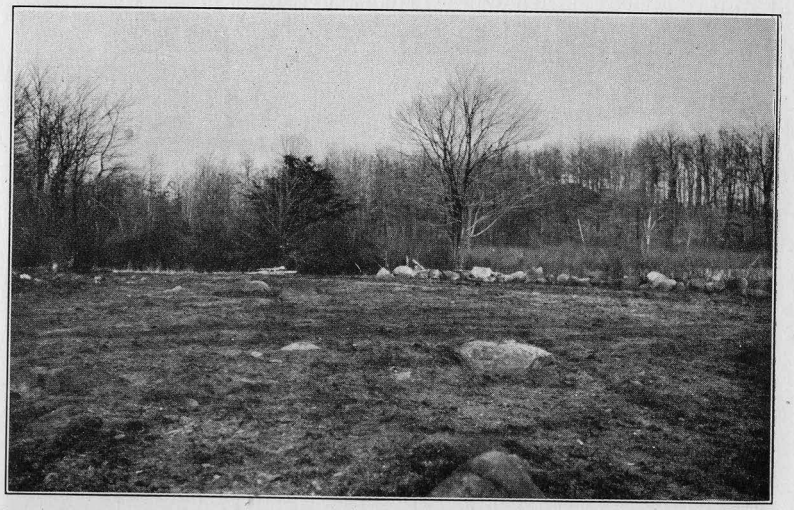


b. Burning weeds and rubbish at infestation No. 2, Groton.

EUROPEAN CORN BORER.



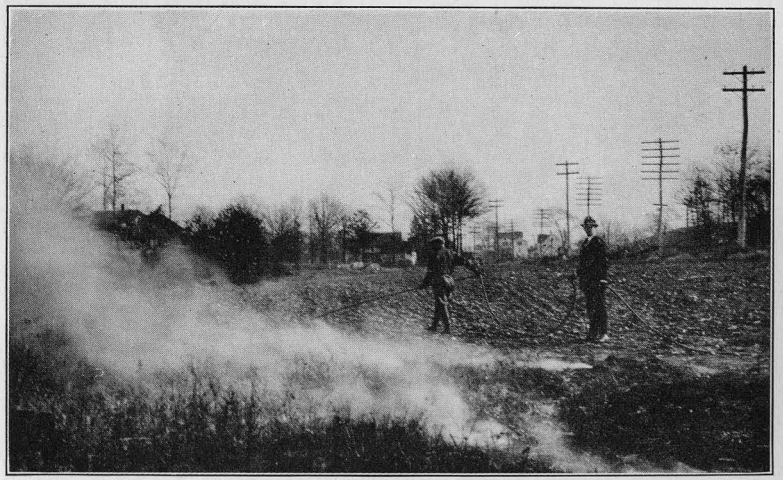
a. Weeds at infestation No. 2, Groton, before burning.



b. View of same field after burning.

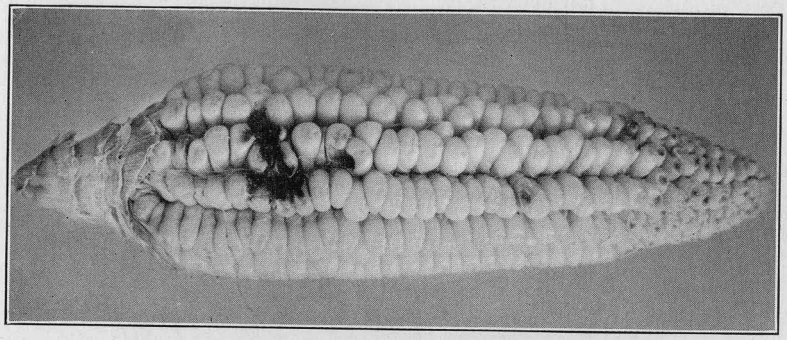
EUROPEAN CORN BORER.

a. Burning corn stalks with the aid of oil applied with hand sprayer, infestation No. 1, Groton.

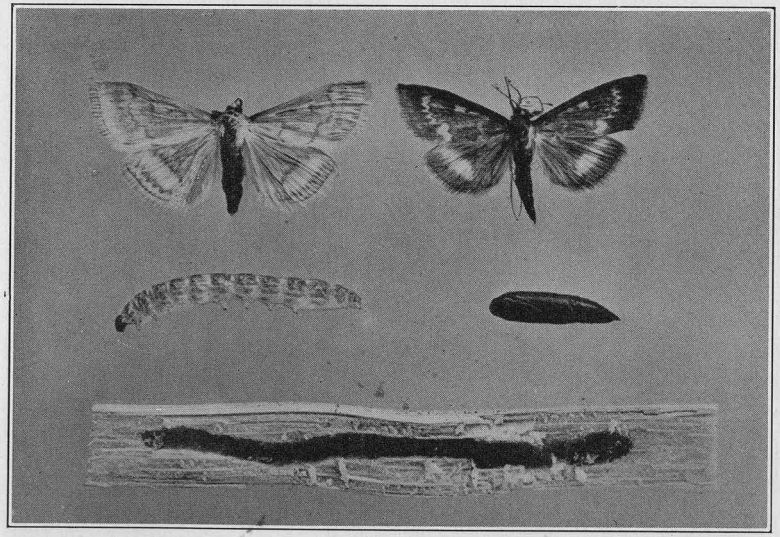


b. Burning weeds with power outfit, infestation No. 2, Groton.

EUROPEAN CORN BORER.

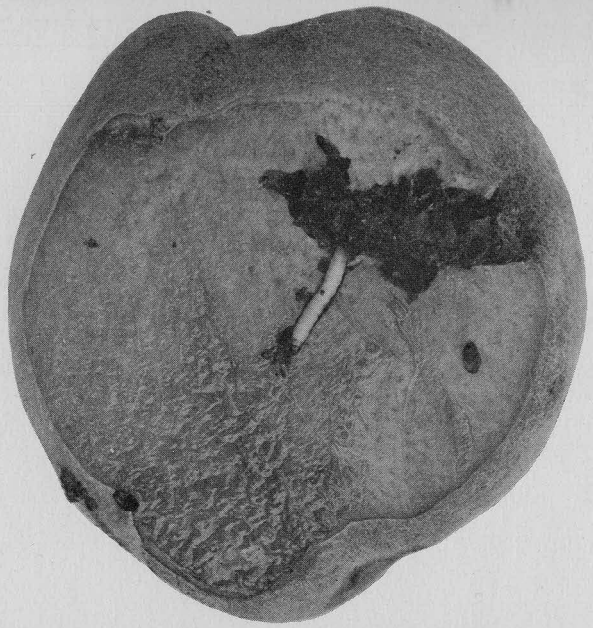


a. Slight injury to ear of sweet corn, Groton.



b. Female, male, larva, pupa and burrow in cornstalk. Slightly enlarged.

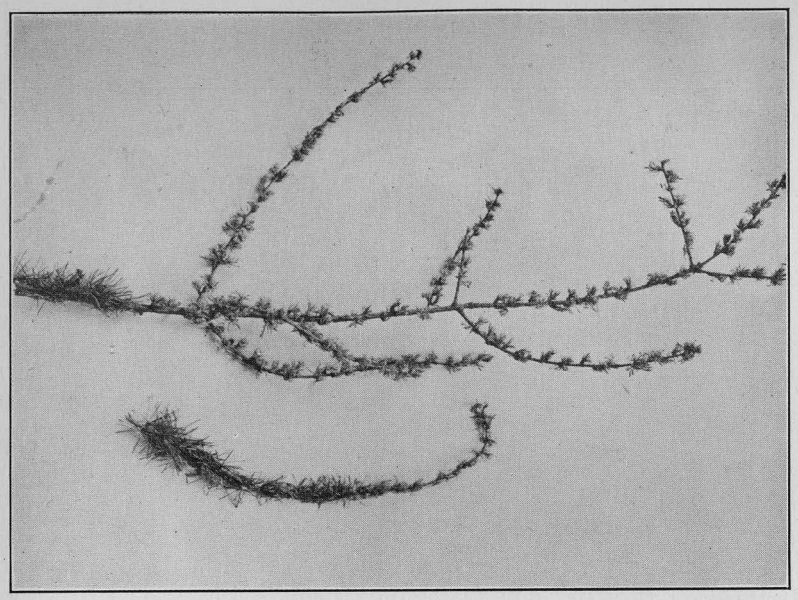
EUROPEAN CORN BORER.



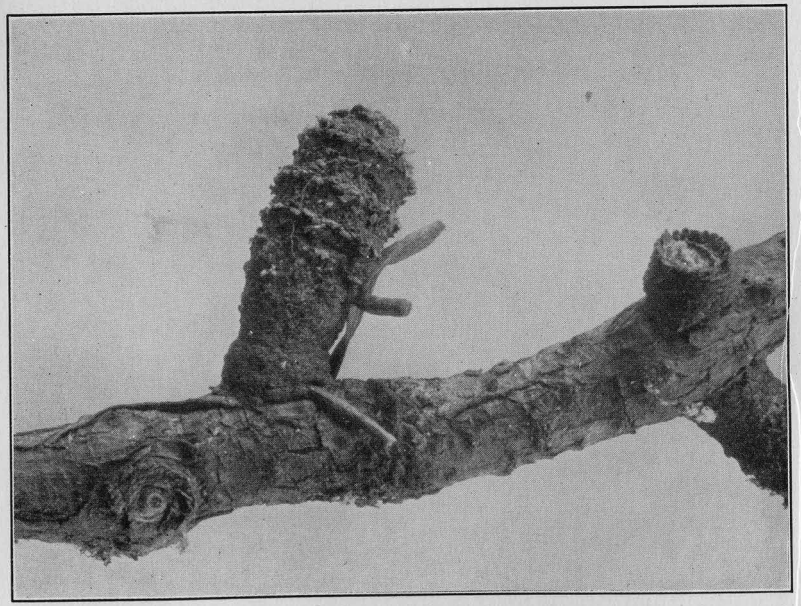
a. Infested peach cut open to show larva. Somewhat enlarged. (After Quaintance and Wood, Bureau of Entomology, U. S. Department of Agriculture.)

b. Peach twigs which have been injured by the larvae. Natural size.

ORIENTAL PEACH MOTH.

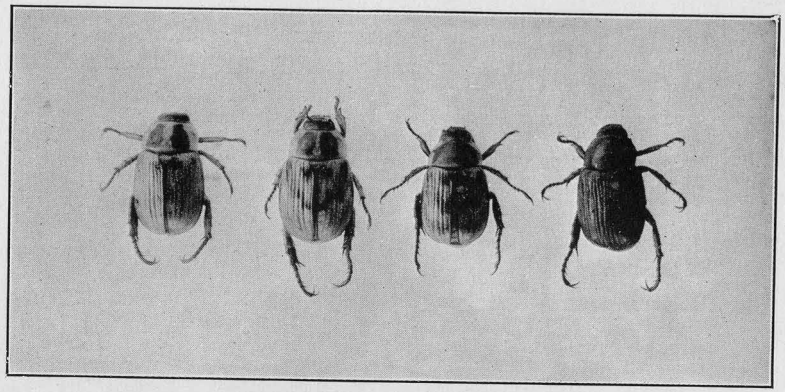


a. Appearance of injured leaves in June.

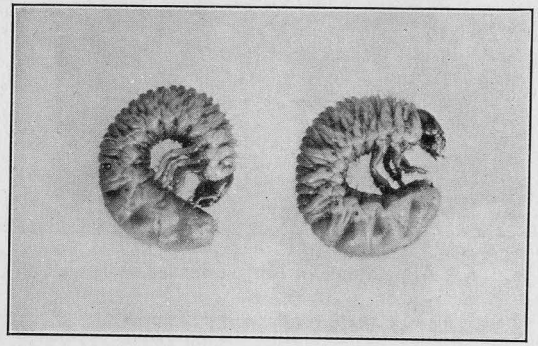


b. Winter cases fastened to twigs, four times enlarged.

LARCH CASE BEARER.



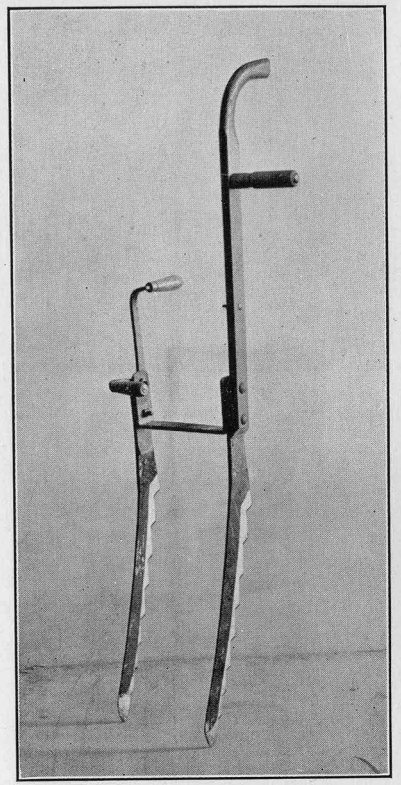
a. Adults showing variation from light brown to black, twice natural size.



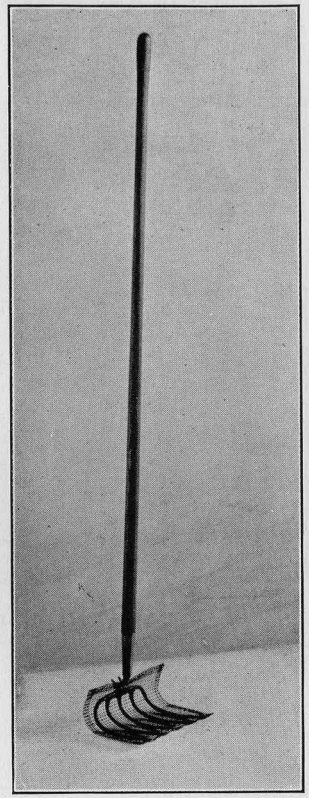
b. Larvae or grubs, twice natural size.

c. Lawn injured by grubs. Grass has been killed in the foreground but back towards the house it is uninjured.

ASIATIC BEETLE.



a. Modified hay knife for recutting ditches in salt marsh.

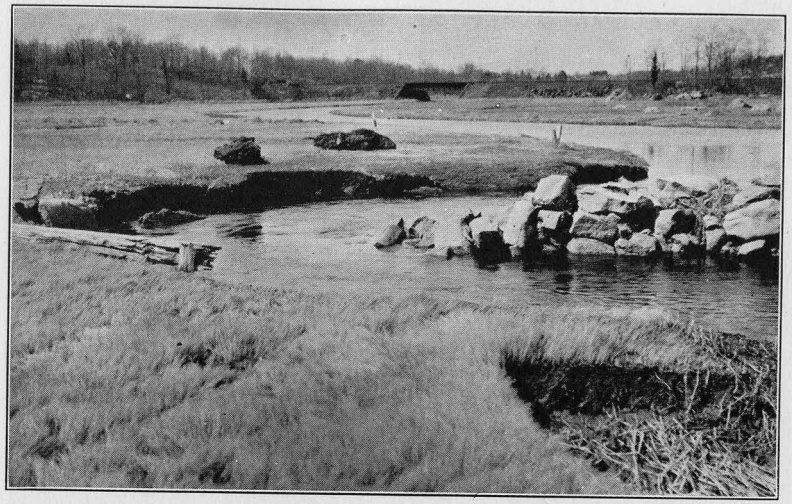


b. Potato hook with prongs covered with wire netting, for removing mud from ditches.

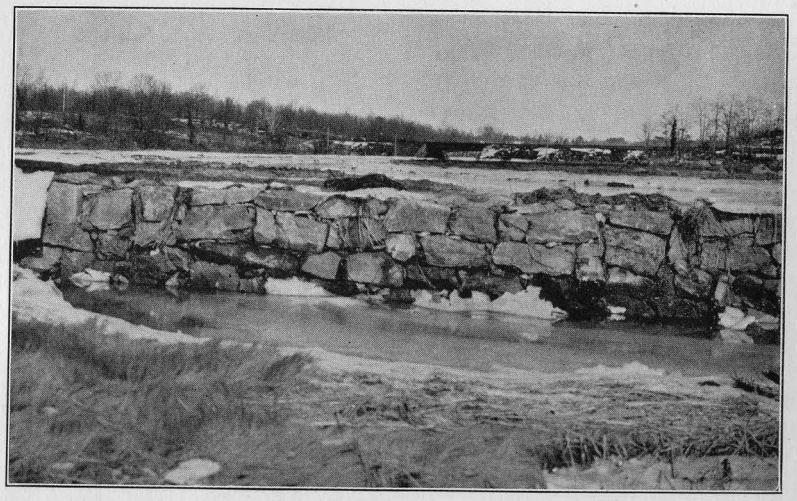
c. Installing a metal culvert through a sand beach to drain the marsh beyond, Westbrook.

MOSQUITO ELIMINATION WORK.

PLATE XXII.



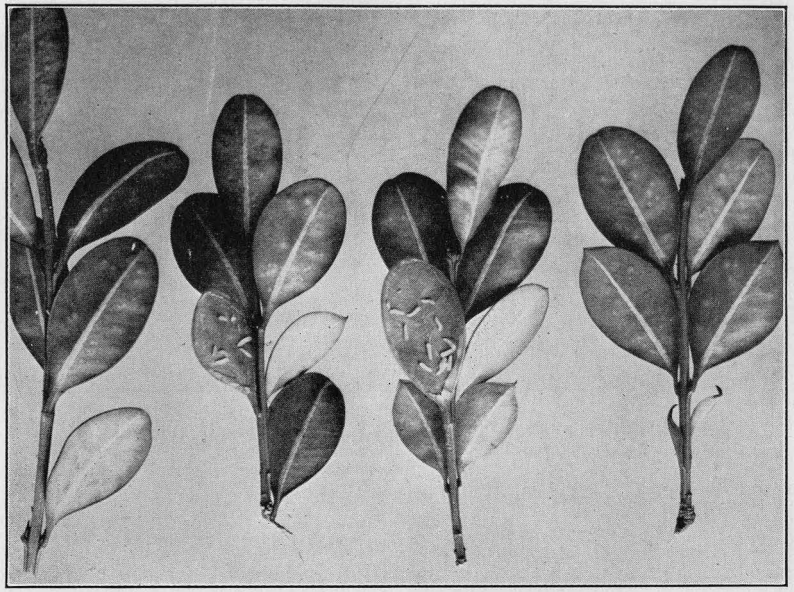
a. Broken dike, Stony Creek.



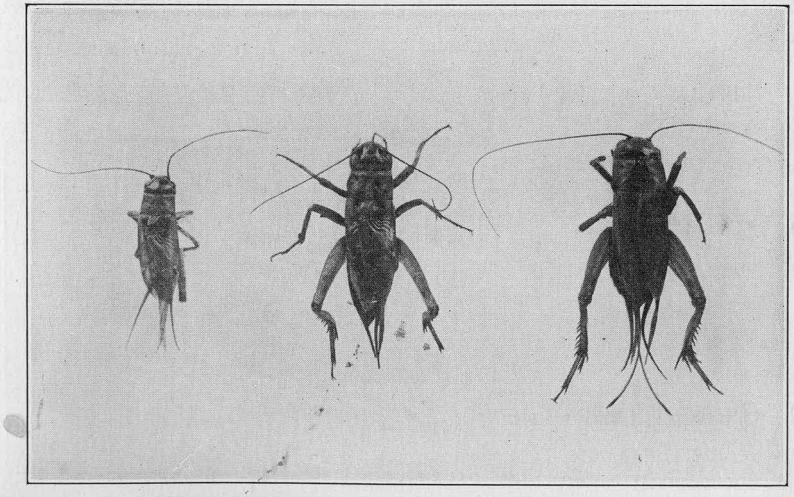
b. New dike, Stony Creek.

MOSQUITO ELIMINATION WORK.

PLATE XXIII.



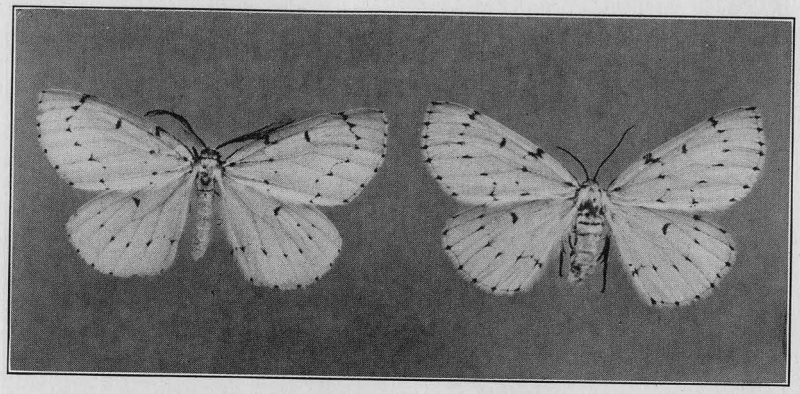
a. Box leaf-miner. White spots on leaves indicate infestation. Lower epidermis has been removed from two leaves, showing maggots. Natural size.



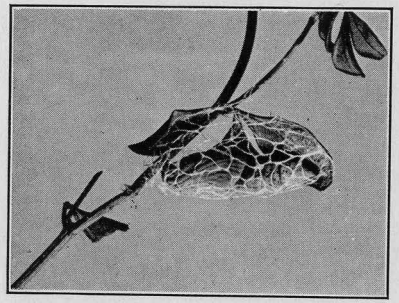
b. European house cricket. Somewhat enlarged.

BOX LEAF-MINER AND EUROPEAN HOUSE CRICKET.

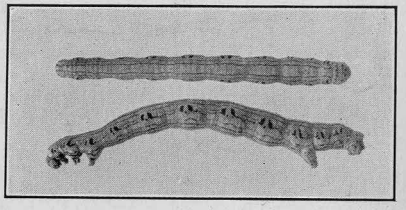
PLATE XXIV.



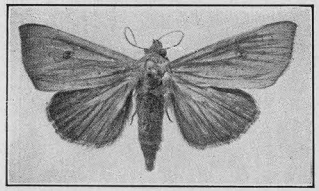
a. Chain-dotted geometer. Adult male and female, natural size.



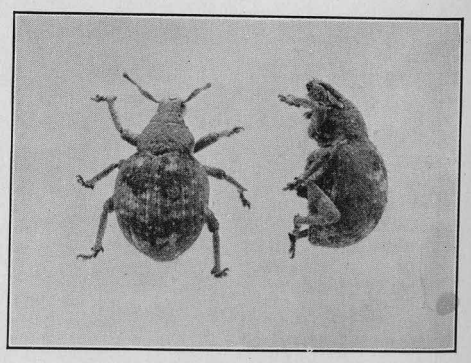
b. Cocoon, natural size.



c. Larvae, natural size.



d. Cotton moth, natural size.



e. Japanese weevil, four times enlarged.

CHAIN-DOTTED GEOMETER, COTTON MOTH AND JAPANESE WEEVIL.

BULLETIN 257 APRIL, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

REPORT ON INSPECTION OF COMMERCIAL FEEDING STUFFS

1923

E. M. BAILEY

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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April, 1924.

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Tobacco Sub-station at Windsor.
N. T. Nelson, Ph.D., *Plant Physiologist.*

The Wilson H. Lee Co.

CONTENTS.

ESSENTIAL PROVISIONS OF THE STATUTES RELATING TO FEEDING STUFFS.

1. All concentrated feeding stuffs must be labelled.

2. The label may be a printed statement on the bag or a tag attached thereto.

3. The label must declare the number of net pounds in the package, the name, brand or trade mark under which the article is sold, the name and address of the manufacturer or jobber, and must give the analysis.

4. Dealers receiving feeds in bulk are responsible for proper labelling of such feeds when bagged by them to be sold or offered for sale. They should require the consignor of such bulk feeds to furnish analyses and other information necessary for proper labelling.

5. Dealers mixing their own brands of stock feeds, dairy feeds, poultry mashes, etc., are responsible for the proper labelling of their products.

6. Cottonseed meal, whether used for a feeding stuff or a fertilizer, must be registered with this Station as a fertilizer and a registration fee paid for each brand registered. A distinctive brand name or a different analysis constitutes a distinct brand.

7. Feeding stuffs other than cottonseed meal have not heretofore been required to be registered. Section 4777 provides, however, that such registration shall be made upon request of this Station. The Station and the Dairy Commissioner believe that such registration is desirable and it is now being asked for. No fee for such registration or for analysis is required.

8. The use of wire or any metal in affixing tags is prohibited by law.

Commercial Feeding Stuffs.

E. M. Bailey.*

TEXT OF THE LAW.

Although no substantial changes have been made in the feeding stuffs law in this State in recent years, nevertheless official inspections have shown that some of the provisions of the law are not understood or are being ignored. For the benefit of wholesale and retail dealers in feeding stuffs the text of the law is here given with comment upon those points which require emphasis.

Section 4774 of the General Statutes defines "Concentrated Commercial Feeding Stuff" as follows:

> "The term 'concentrated commercial feeding stuff' shall include linseed meals, cottonseed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chop, corn and oat feeds, ground beef, fish scraps, mixed feeds, provenders, bran, middlings and mixed feeds made wholly or in part from wheat, rye or buckwheat and all materials of a similar nature, but shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the seed of wheat, rye, barley, oats, Indian corn, buckwheat or broom corn nor feed ground from whole grain and sold directly from manufacturer to consumer."

From this it appears that practically all feeds excepting hay and straw, whole seed, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer, are included in the term "Concentrated Commercial Feeding Stuff".

Section 4775 states the requirements as to labelling. This section reads as follows:

> "Every lot or parcel of concentrated commercial feeding stuff, sold, offered or exposed for sale, shall have affixed thereto in a conspicuous place on the outside thereof a plainly printed statement, except as provided in section 4776, certifying the number of net pounds of feeding stuff contained therein, the name, brand or trade-mark under which the article is sold, the name and address of the manufacturer or importer, and a statement of the percentage it contains of crude fat and of crude protein, both constituents to be determined by the methods adopted at the time by the association of official agricultural chemists of the United States, but such lot or parcel shall not be sold, offered or exposed for sale with such statement affixed thereto by any wire or other metal".

*Analyses are chiefly by Messrs. Nolan and Fisher; inspection and sampling by Mr. Churchill; compilation of results largely by Miss Bacon.

In accordance with this section all concentrated feeding stuffs must bear *upon the bag*, or *a tag attached thereto*, a statement giving the *name and address* of the manufacturer or importer, the *number of net pounds in the package*, the *name of the article* and the *percentage of protein and fat* contained in it. Dealers receiving feeding stuffs in bulk to be bagged and distributed by them should see to it that tags bearing a correct analysis and other information required by law are attached to the bags before the feeds are sold or offered for sale. Dealers mixing their own brands of feeds are responsible for the proper labelling of their products. *It is illegal to use wire* or any other metal in affixing tags.

While the law requires that only the percentage of *protein* and of *fat* be stated, there is no objection to a statement of the complete chemical analysis. Likewise, in the case of mixed feeds, there is no objection to a statement of the ingredients used in compounding them, but the law in this State does not require it. If, however, such additional information is given it is expected to be correct.

If a complete analysis is given the term *"nitrogen-free extract"* as used therein means the figure obtained by deducting the sum of the percentages of moisture, ash, protein, crude fiber and fat from 100 per cent. The term *"carbohydrates"* includes the nitrogen-free extract and crude fiber.

Section 4776 relates to cottonseed meal when sold for fertilizer. It reads as follows:

"Whenever cottonseed meal is sold for fertilizer, the dealer shall, with the consent of the purchaser, issue in lieu of the printed statement provided for in section 4775, a certificate which shall contain the statements required by section 4775".

Attention is called to the fact that, under the fertilizer law, cottonseed meal is classed as a fertilizer. *All cottonseed meal and each brand thereof, sold, offered or exposed for sale in Connecticut must, therefore, be registered as a fertilizer with this Station and an analysis fee of ten dollars paid thereon. Distinctive names or different guaranties of composition constitute distinct brands.*

Section 4777 relates to registration of feeds as follows.

"Every manufacturer, importer, agent or seller of any concentrated commercial feeding stuff shall, upon request, file with the Connecticut Agricultural Experiment Station a certified copy of the statement prescribed in Sections 4775 and 4776."

The law does not require the registration of feeding stuffs, *except* upon request of this Station. *As already noted, however, it is considered advisable to have feeding stuffs registered and such registrations are now being asked for.*

Section 4778 provides the penalty for violations of the law. It reads as follows:

"Every manufacturer, importer, agent or person selling, offering or exposing for sale any concentrated commercial feeding stuff in relation to which all the provisions of sections 4775, 4776 and 4777 have not been complied with, shall be fined not more than one hundred dollars for the first offense and not more than two hundred dollars for each subsequent offense."

Section 4779 relates to the inspection and analysis of feeds and the publication of the results for public information. This section provides that:

"The Connecticut Agricultural Experiment Station may collect a sample, not exceeding two pounds in weight, for analysis, from any lot, parcel or package of concentrated commercial feeding stuff, or unmixed meals, brans or middlings, which may be in the possession of any manufacturer, importer, agent or dealer, but said sample shall be taken in the presence of the parties in interest or their representatives, and taken from a number of parcels or packages which shall not be less than five per centum of the whole lot inspected, and shall be thoroughly mixed, divided into two samples, placed in glass vessels, carefully sealed, and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was taken, and the time and place of taking the same; said label shall be signed by the station chemist or his deputy, and by the party or parties in interest or their representatives present at the taking and sealing of said sample; one of said samples shall be retained by said chemist or his deputy and the other by the party whose stock is sampled. Said station shall cause at least one sample of each brand of feeding stuff so collected to be analyzed annually by or under the direction of said chemist. Said analysis shall include determinations of crude fat and crude protein and such other determinations as may be advisable. Said station shall cause the analysis so made to be published in station bulletins, together with such additional information in relation to the character, composition and use thereof as may be of importance and issue the same annually or more frequently if advisable".

Section 4780 provides for the enforcement of the law. It says:

"The dairy and food commissioner shall enforce the provisions of this chapter, and when evidence is submitted by the Connecticut Agricultural Experiment Station that said provisions have been violated, he shall make complaint to the proper prosecuting officer".

The dairy and food commissioner is charged with the enforcement of the law and prosecutes violations upon evidence submitted by this Station.

Section 4781 defines the term "importer" as used in the law as follows:

"The term 'importer' shall include such persons as shall bring into or offer for sale within this state concentrated commercial feeding stuffs manufactured without this state".

GRATUITOUS ANALYSES OF FEEDING STUFFS.

Samples Submitted By Individuals.

The foregoing relates to the inspection of feeding stuffs for purposes of official control. The Station is frequently called upon, however, to make analyses of feeds upon samples drawn by the

individuals interested. While the Station assumes no responsibility for the sampling in such cases, it insists that the samples be taken substantially as prescribed by law. Blank forms to be filled out by the person submitting the sample will be supplied by the Station upon request.

Dealers who mix their own formulas sometimes submit samples for the purpose of using our analysis as a basis for their guaranty. The Station assumes no control in such matters, and in no way guarantees that such analysis represents the minimum or average composition of the stock sampled; it is responsible only for the correctness of the analysis of the sample submitted.

While the Station is disposed to cooperate with both farmer and dealer in the matter of gratuitous analyses it reserves the right to refuse this privilege in case samples are submitted from any source with such frequency as to warrant the belief that its resources are being used to exercise systematic control over purchases made by an individual buyer. This policy applies not only in the case of feeding stuffs but to fertilizers and gratuitous work in general.

Description of Sample.

For a proper description of a sample of feeding stuff the following information should be given:

Sampler's identification mark or number.
Name of the feed.
Name and address of the manufacturer or jobber.
Name and address of the dealer.
Car Number.
Number of sacks from which sample was taken.
Guaranty:
    Protein,
    Fat,
    Other constituents if given.
Date of sampling.
Price per ton.
Remarks.

Instructions for Sampling Feeding Stuffs.

An analysis is of no value if the sample submitted is inadequate or carelessly taken. In cases of special importance the Station may be requested to send its agent to draw samples.

Provide a sampling tube, some large papers, and for each sample a glass jar or tin box that can be tightly closed. Containers, sampling tube, etc., should be clean and dry.

The quantity of the sample should be not less than one pint.

Open at least three full unbroken packages (or bags), or if there are more than thirty, one in every ten packages, or from a car lot not less than twenty packages, remove a *core* from each opened package by inserting the sampling tube the full length of the package, mix the portions thus drawn thoroughly and as quickly as possible, fill the can or box from the mixture, close tightly and identify the sample with some distinguishing number or letter.

If the feed is in bulk draw portions from various parts of the pile, the number depending upon the size of the pile; twenty portions should be drawn for a sample from a carload.

If a sampling tube is not available a fairly satisfactory sample may be obtained as follows: Mix the contents of each package for a foot in depth, take a cupful from each package, mix the portions thus drawn and prepare the sample as already described.

Samples drawn by means of a sampling tube are much more reliable.

Send the sample prepaid to the Connecticut Agricultural Experiment Station, New Haven, Conn., and enclose with it or mail separately the *description of the sample* as herein described.

RÔLE OF THE NUTRIENTS.

Water. Air dry feeding stuffs, whether concentrates or roughage, still contain some moisture which cannot be seen or felt. The amount of such moisture averages not far from ten per cent. While not a nutrient in the ordinary sense, water is essential to the animal; but since it is obtained in abundance from sources other than the feed, its presence therein is not of importance. Excessive amounts, however, jeopardize the keeping qualities of a feed and automatically reduce the percentage of the more desirable ingredients.

Ash. The importance of mineral constituents in feeds is emphasized by the fact that animals fed upon rations deprived largely or entirely of ash constituents generally die sooner than animals which have been given no food at all. Giving stock mineral matter in addition to that obtained in the daily ration is an old and familiar practice among experienced stockmen who have long "salted their cattle" with common salt (sodium chloride), the commercial grades of which contain small and varying amounts of other minerals such as calcium, magnesium, iron and phosphorus and sulphur. Recent studies in nutrition have shown some of the specific needs which minerals satisfy in the vital processes. Thus big neck in calves, colts and lambs, and hairlessness in pigs are now attributed to iodine deficiency in the feed; and defective skeletal formation in growing animals is due either to a lack of calcium and phosphorous or to an absence of the necessary agency to make the proper utilization of these minerals possible, for it has been shown that without what has been called the fourth, or antirachitic, vitamine which is present in cod liver oil and in green plant tissues, calcium and phosphorous cannot be properly assimilated.

Protein. This nutrient group is estimated by determining the amount of nitrogen which a feed contains and multiplying that amount by the factor 6.25 on the assumption that proteins uniformly contain 16 per cent. of nitrogen. While this method of estimation is not strictly accurate it is as close an approximation as it is generally possible or practicable to get. From protein the

body repairs waste, builds new tissue and, to a lesser extent, derives heat and energy. It was formerly thought that all proteins were adequate for all these processes, but it is a comparatively recent contribution to our knowledge that they are not. Protein is a complex substance made up of nineteen separate parts called amino acids. Proteins which contain some of all the various amino acids are called "complete" proteins; those in which one or more amino acids are lacking are called "incomplete". Undoubtedly all these separate parts play some rôle in vital processes; more particularly we know that tryptophane and lysine are essential to a normal rate of growth. The proteins of cereal grains are relatively low in the two amino acids just mentioned while proteins of animal origin, such as milk, meat, and eggs, are rich in these two substances; thus the logic of supplementing grain rations with skimmed milk or tankage is apparent. Grain mixtures alone may suffice if fed in sufficient quantity but it may happen that the energy requirements of the animal will become satisfied by non-protein constituents of the ration and its appetite fail before enough of the necessary amino acids has been acquired.

Knowledge of digestible nutrients and nutritive ratios are not the final criteria by which rations are to be adjusted. The right kind and quality of protein must be supplied.

Crude Fiber. By this term is meant the coarser and more woody tissue characteristic of all forms of roughage and present in the outer coats of cereal and other fodder grains. It belongs to the carbohydrate group and is, in part, digested by ruminant animals. Its chief value lies in its mechanical effect in the intestinal tract.

Nitrogen-free Extract. In this class are included the relatively more digestible carbohydrates of the starch and sugar types. Their principal rôle in nutrition is to supply heat and energy, but they have also the power of sparing protein, by which is meant that when fed together with protein they reduce the amount of the latter food required. An excess of this carbohydrate group over the immediate needs of the body can be transformed into fat and stored in the body tissue.

The term "carbohydrate" as applied to a feeding stuff properly means "crude fiber" and "nitrogen-free extract" combined. Nitrogen-free extract is obtained by deducting from 100 per cent. the sum of the percentages of moisture, ash, protein, fiber and fat (ether extract).

Fat (Ether Extract). Fats, like the carbohydrates, furnish energy to the body and like them also, but to a lesser extent, spare protein. As energy producers their value is 2.25 times greater than that of either carbohydrate or protein. This ether-soluble material is in all cases crude fat, by which we understand that non-fatty substances like chlorophyll and coloring matter may be included therein.

Accessory Nutritive Factors. In this class are included the *vitamines*. There is not likely to be a deficiency of the vitamines A, B, and C in rations of domestic animals but the antirachitic vitamine by reason of its influence on the assimilation of calcium and phosphorus, as already noted, is of very practical importance. Green fodder or properly cured leguminous hay will supply this factor. The beneficial influence of sunlight upon the growth and development of animals has also been strikingly demonstrated, and it may be classed with the vitamines as an accessory nutritive factor.

DIGESTIBLE NUTRIENTS.

The gross amount of nutrient material taken into the animal body is probably never completely utilized. That portion of such material which actual feeding tests have shown is retained in the animal body, is taken to be the coefficient of digestibility of that material and is expressed in per cent.

Thus, for cottonseed meal it has been found that, on the average 85 per cent. of the protein, 37 per cent. of the fiber, 75 per cent. of the carbohydrates and 95 per cent. of the fat are digestible; or, in other words, out of each 100 parts of protein, of fiber, of carbohydrates and of fat that an animal eats, 85, 37, 75 and 95 parts, respectively, are retained in the body; i.e., not excreted. These figures are taken, therefore, to be the coefficients of digestibility for the several nutrients as they are found in cottonseed meal.

Coefficients of digestibility for some common commercial concentrates are given in the following table.

TABLE I. COEFFICIENTS OF DIGESTIBILITY OF FEEDING STUFFS.[1]

Feed.	Average dry matter, lbs. per hundred.	Coefficient of digestibility.			
		Protein.	Carbohydrate.		Fat.
			Fiber.	Nitrogen free extract.	
Cottonseed Meal	92.2	84	37	75	95
Cottonseed Feed	91.7	58	45	61	90
Linseed Meal (Old Process)	90.9	89	57	78	89
Wheat Bran	89.9	78	31	72	68
Wheat Middlings	89.6	77	30	78	88
Wheat Feed	89.9	77	36	76	87
Rye Feed	88.5	80	..	88	90
Buckwheat Middlings	88.0	87	32	86	83
Oat Feed	93.5	75	42	46	78
Oat Middlings	93.1	80	49	85	93
Corn Gluten Feed	91.3	85	76	88	85
Gorn Gluten Meal	90.9	85	55	90	93
Hominy Feed	89.9	66	76	90	91
Brewers' Grains	92.5	81	49	57	89
Dried Beet Pulp	91.8	52	83	83	..

[1]Henry and Morrison: Feeds and Feeding, 18th Ed.

INSPECTION AND ANALYSES.

Classification of Samples.

Commercial feeding stuffs and other fodder materials examined during the past year may be classified as follows:

Official samples drawn by the Station agent	201
Samples submitted by individuals or drawn by the Station agent on request	48
Samples examined for Storrs station	100
Samples examined for Department of Plant Breeding	3
Total	352

Official samples taken in course of the regular inspection are classified as follows:

Cottonseed Products	12	Maize Products	22
Linseed Products	6	Brewers' Products	2
Wheat Products	41	Dried Beet Pulp	5
Rye Products	2	Proprietary Stock Feeds	73
Wheat and Rye Products	1	Poultry Feeds	33
Buckwheat Products	2		
Oat Products	2	Total	201

Only official samples collected by the Station agent and those submitted by individuals are discussed in this report.

Remarks on Analyses.

(*Analyses in Table III, pages 336-355*).

The definitions of feeding stuffs here given are those adopted by the Association of Feed Control Officials as revised to November, 1923.

Samples were collected in November and December of 1923 and prices, where given, are those quoted at that time.

COTTONSEED MEAL.

41.12 Per cent. Protein Cottonseed Meal, Choice Quality, must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and by analysis must contain at least 41.12 per cent. crude protein, equivalent to 8 per cent. of ammonia.

Cotton seed meal not fulfilling the above requirements as to color, odor, or texture, shall be branded Off Quality.

38.56 Per cent. Protein Cottonseed Meal, Prime Quality, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and by analysis must contain at least 38.56 per cent. crude protein, equivalent to 7.5 per cent. of ammonia.

Cottonseed meal not fulfilling the above requirements as to color, odor or texture, shall be branded Off Quality.

36 Per Cent. Protein Cottonseed Meal, Good Quality, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, free from excess lint and must contain at least 36 per cent. crude protein, equivalent to 7 per cent. of ammonia.

Cottonseed Meal not fulfilling the above requirements as to color, odor or texture, shall be branded Off Quality.

Eleven samples were examined, two of which, **22135** and **22004,** were deficient in protein by more than 1 per cent. One, **22013,** had the tags secured by wire which is illegal.

The average composition as regards protein, fiber and fat was 37.9 per cent., 11.2 per cent. and 6.4 per cent., in the order named. The average cost per ton was $56.18.

In the inspection a year ago it was shown that protein was purchased at better advantage in 43 per cent. meal, 14.4 pounds of protein being purchased for $1.00 in the first named grade as compared with 12.5 pounds in the last named grade. A similar comparison this year shows for 43 per cent. meal 14.4 pounds and for 36 per cent. meal 13.3 pounds. Again the comparison favors the highest grade; the data, however, are based upon a rather limited number of samples, particularly of the 43 per cent. group.

COTTONSEED FEED.

Cottonseed Feed is a mixture of cottonseed meal and cottonseed hulls containing less than 36 per cent. protein.

One sample, *White Mule* brand, was guaranteed to contain 36 per cent. of protein and 39 per cent. was found; in other respects also the guaranty was exceeded.

LINSEED MEAL.

Linseed Cake or Meal is oil cake or meal made from flaxseed, provided that the final product shall contain less than 6 per cent. of weed seeds and other foreign materials and, provided, further that no portion of the stated 6 per cent. of weed seeds and other foreign materials shall be deliberately added.

Old Process Oil Meal, Old Process Linseed Meal is oil meal as defined or linseed meal as defined produced by crushing, cooking and hydraulic pressure.

The six samples examined satisfied their guaranties in all respects. One, **22176,** had tags secured by wire which is illegal.

The average protein content was 31.9 per cent. and the average cost per ton was $56.83. This is 2 per cent. less protein than was found last year and the price per ton is about $4.00 less.

WHEAT BRAN.

Wheat Bran is the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling.

Nineteen samples of wheat bran were examined. All substantially met or exceeded the guaranties for protein and no

deficiencies in fat or excesses of fiber were found. Two samples, **22102** and **22117**, had tags attached by means of wire.

The quality of the samples examined equals the average of other years, but the cost per ton is about $4.00 more than last year and nearly $12.00 in advance of the average price quoted two years ago.

WHEAT MIDDLINGS

Standard Middlings consists mostly of fine particles of bran, germ and very little of the fibrous offal obtained from the "tail of the mill." This product must be obtained in the usual commercial process of milling and shall not contain more than 9.5 per cent. crude fiber.

Flour Middlings shall consist of standard middlings and red dog flour combined in the proportions obtained in the usual process of milling and shall not contain more than 6.0 per cent. crude fiber.

Red Dog Flour consists of a mixture of low-grade flour, fine particles of bran and the fibrous offal from the "tail of the mill" and shall not contain more than 4.0 per cent. crude fiber.

Brown Shorts (*Red Shorts*) consists mostly of the fine particles of bran, germ and very little of the fibrous offal obtained from the "tail of the mill". This product must be obtained in the usual commercial process of milling.

Gray Shorts (*Gray Middlings* or *Total Shorts*) consists of the fine particles of the outer bran, the inner bran or bee-wing bran, the germ and the offal or fibrous materials obtained from the "tail of the mill." This product must be obtained in the usual process of commercial milling.

White Shorts or *White Middlings* consists of a small portion of the fine bran particles and the germ and a large portion of the fibrous offal obtained from the "tail of the mill." This product must be obtained in the usual process of flour milling.

Brown shorts, gray shorts and white shorts are further differentiated on the basis of fiber contents, tentative limits for which have been set at 6.5, 5.5 and 3.5 per cent. for the classes in the order named.

Standard middlings differ from brown shorts (red shorts), in that the latter have less fiber; 3 per cent. less according to the tentative fiber limits which have been adopted.

None of the samples exceeded the limits of fiber set for standard middlings. In many cases the fiber is low enough to classify them as shorts although the labels seldom declare such grade. Protein and fat guaranties were met or exceeded in all cases. The average composition for this group of feeds is protein 17.3 per cent., fiber 6.1 per cent. and fat 5.5 per cent. The average ton price is about $5.00 in advance of that quoted in the previous inspection.

MIXED FEED.

Wheat Mixed Feed (*Mill Run Wheat Feed*) consists of pure wheat bran and the gray or total shorts or flour middlings combined in the proportions obtained in the usual process of commercial millings.

The tentative limits for fiber content of mixed feed in 8.5 per cent.; and for hard wheat mixed feed 9.5 per cent.

The average fiber content for this group as shown by analyses was 7.1 per cent. and no single sample exceeded 8.5 per cent. No deficiencies in protein or in fat were found. The average composition was found to be protein 16.3 per cent., fiber 7.1 per cent. and fat 5.4 per cent. An increase in price of about $4.00 per ton is noted as compared with the inspection a year ago.

RYE PRODUCTS.

Rye Middlings or *Rye Feed* is the by-product obtained from the manufacture of ordinary "100 per cent." rye flour from cleaned and scoured rye grain.

Two samples of rye middlings were examined both of which satisfied their guaranties in all respects.

WHEAT AND RYE PRODUCTS.

A sample of the mixed middlings of wheat and rye was found to fully conform to its guaranty.

BUCKWHEAT PRODUCTS.

Buckwheat Shorts or *Buckwheat Middlings* are that portion of the buckwheat grain immediately inside of the hull after separation from the flour.

Two samples were examined one of which was described as consisting of middlings, buckwheat hulls and buckwheat screenings. This last named feed was high in fiber, as might be expected, but did not exceed the limit of fiber declared. The sample of buckwheat middlings, **22148**, was without a statement of guaranty.

OAT PRODUCTS.

Oat Middlings are the floury portions of the oat groat (kernel), obtained in the milling of rolled oats.

Oat Shorts are the covering of the oat grain lying immediately inside the hull, being a fuzzy material carrying with it considerable portions of the fine floury part of the groat obtained in the milling of rolled oats.

Two samples were examined. One, *Corno*, was described as a mixture of oat middlings, oat shorts and oat hulls.

Both samples conformed to their guaranties.

CORN-GLUTEN FEED.

Corn Gluten Feed is that portion of commercial shelled corn that remains after the separation of the larger part of the starch and the germs by the processes employed in the manufacture of cornstarch and glucose. It may or may not contain corn solubles.

Five samples were examined and all substantially equalled or exceeded their guaranties for protein and fat. The average price per ton, $55.20, is about $6.00 higher than quoted a year ago.

CORN GLUTEN MEAL.

Corn Gluten Meal is that part of commercial shelled corn that remains after the separation of the larger part of the starch, the germ and the bran, by the processes employed in the manufacture of cornstarch and glucose. It may or may not contain corn solubles.

The one sample examined considerably exceeded the guaranty for protein and fat.

HOMINY FEED.

Hominy Feed, Hominy Meal or Hominy Chop is the kiln-dried mixture of the mill run bran coating, the mill run germ, with or without a partial extraction of the oil and a part of the starchy portion of the white corn kernel obtained in the manufacture of hominy, hominy grits and corn meal by the degerminating process.

Sixteen samples were analyzed and no deficiencies in protein or excesses of fiber were found. Five samples showed deficiencies in ether extract (crude fat), greater than 0.25 per cent. One sample, **22175**, bore tags attached by means of wire.

BREWERS' GRAINS.

Brewers' Dried Grains are the properly dried residue from cereals obtained in the manufacture of beer.

Two samples were examined one of which, **22067**, was 1.12 per cent. low in protein.

DRIED BEET PULP.

Dried Beet Pulp is the dried residue from sugar beets which have been cleaned and freed from crowns, leaves and sand, and which have been extracted in the process of manufacturing sugar.

Five samples were examined all of which satisfied the requirements of their guaranties.

PROPRIETARY MIXED FEEDS.

These feeds aim to supply ready mixed so-called balanced rations for the various classes of farm animals. Some, no doubt, are compounded carefully and with the best available information of feed values. Chemical analyses will furnish data as to the gross amounts of the several nutrients from which may be estimated the digestible nutrients; but only feeding practice will demonstrate the quality of the nutrients.

A study of the analyses tabulated under the heading of "Horse, Dairy and Stock Feeds", p. 346, shows that there are, exclusive of three calf meals, seventy samples which may be divided into three nearly equal groups on the basis of their protein content, viz., 10 per cent., 20 per cent. and 25 per cent. As there are only four samples which would fall in a 15 per cent. group no separate classification was made for these, but they were placed in the 10

per cent. or the 20 per cent. groups. The 10 per cent. group includes feeds of protein content ranging roughly from 8 to 14 per cent.; the 20 per cent. group ranges from 17 to 22 per cent.; and the 25 per cent. group includes all those having above 22 per cent. of protein.

The average composition of each of these three groups as regards protein, nitrogen-free extract and fat and the average price per ton is given in the following summary:

AVERAGE PERCENTAGES OF NUTRIENTS AND PRICES PER TON IN THREE GROUPS OF PROPRIETARY FEEDS.

Group	No. of Samples.	Protein.	Nitrogen-free Extract.	Fat.	Price Per Ton.
Protein 10 per cent.	26	10.11%	63.92%	4.22%	$44.52
Protein 20 per cent.	23	19.60	53.62	5.08	51.27
Protein 25 per cent.	21.	24.16	48.85	5.29	53.76

On the basis of amounts of nutrients secured for one dollar in each of these three groups the following comparison can be made.

NUTRIENTS FOR ONE DOLLAR IN THREE GROUPS OF PROPRIETARY FEEDS.

Group	Protein. lbs.	Nitrogen-free extract. lbs.	Fat. lbs.
Protein 10 per cent.	4.5	28.3	1.9
Protein 20 per cent.	7.7	20.9	2.0
Protein 25 per cent.	9.0	13.2	2.0

These comparisons are based upon the gross amounts of nutrients. By reason of the miscellaneous sources from which the nutrients in proprietary feeds are derived and the difficulty in ascertaining the exact proportions of the ingredients, digestible nutrients cannot be accurately computed. The comparative figures given show that the price per ton increases as the protein content of the feed increases; protein is the most expensive of the nutrients. Fat does not vary greatly in the three groups and the amounts secured for the unit price are practically identical. For the same amount of money the feeder secures in the 20 per cent. protein group two-thirds more protein and one-fourth less nitrogen-free extract than in the 10 per cent. protein group; in the 25 per cent. protein group he secures twice as much protein and one-third less nitrogen-free extract than in the 10 per cent. protein group. So far as protein is concerned the lowest priced feeds are, on the average, its most expensive source.

SUMMARY OF DEFICIENCIES.

In Table II is given a summary of those feeds which were found not to meet the requirements of their guaranties or were otherwise illegal. Only variations from guaranty greater than 1 per cent. in protein and fiber and 0.25 per cent. in fat are noted.

TABLE II. FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILLEGAL.

Station No.	Manufacturer and Brand	Protein Deficiency	Fat Deficiency	Fiber Excess	Remarks
	COTTONSEED MEAL.	%	%	%	
22135	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga.	1.50	....	....	.....
22004	Good. The Cameron-Daniel Co., Atlanta, Ga.	1.25	....	....	.....
22013	Buckeye. Buckeye Cotton Oil Co., Cincinnati, Ohio	....	....	....	Wire tags, illegal.
	LINSEED MEAL.				
22176	Kellogg & Miller, Amsterdam, N. Y.	....	....	....	Wire tags, illegal.
	WHEAT BRAN.				
22102	Larabee Flour Mills Corp., Wellington, Kansas	....	....	....	Wire tags, illegal.
22117	Leavenworth Milling Co., Leavenworth, Kansas	....	....	....	Wire tags, illegal.
	HOMINY FEED.				
22030	Acme. Acme Evans Co., Indianapolis, Ind.	....	1.04	....	.....
22120	Badger. Chas. A. Krause Milling Co., Milwaukee, Wis.	....	0.27	....	.....
22002	Sonny South. Louisville Milling Co., Louisville, Ky.	....	0.90	....	.....
22175	Patent Cereals Co., Geneva, N. Y.	....	0.32	....	Wire tags, illegal.
22162	Paragon. Chas. M. Cox, Boston, Mass.	....	1.13	....	.....
	BREWER'S PRODUCTS.				
22067	Bull. Farmers' Feed Co., New York City	1.12	....	....	.....
	PROPRIETARY MIXED FEEDS.				
22021	Portage Stock Feed. Akron Feed & Milling Co., Akron, Ohio	....	0.50	1.41	.....
22147	Direct Stock Feed. Thomas-Boyce Feed Co., Attica, N. Y.	....	1.43	....	.....
22168	Nobotheration Stock Feed. C. W. Campbell Co., Westerly, R. I.	....	1.62	....	.....
22185	Davis Stock Feed. R. G. Davis & Sons, New Haven, Conn.	1.87	1.79	....	.....

TABLE II. FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILLEGAL—*Concluded.*

Station No.	Manufacturer and Brand	Protein Deficiency	Fat Deficiency	Fiber excess	Remarks
	PROPRIETARY MIXED FEEDS—Concluded.	%	%	%	
22079	Milkmore Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass.	....	0.89	....	.....
22121	Elmore Milk Grains. Elmore Milling Co., Oneonta, N. Y.	....	0.85	....	.....
22023	Algrane Milk Feed. H-O Cereal Co., Inc., Buffalo, N. Y.	....	0.63	....	.....
22058	Red Star Dairy Feed. E. Manchester & Sons, Winsted, Conn.	2.87	....	....	.....
22108	Red Wing Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	3.87	....	....	.....
22131	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	2.12	0.73	....	.....
22134	Red Wing Stock Feed. Meech & Stoddard, Inc., Middletown, Conn.	....	....	2.47	.....
22183	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	1.81	0.62	....	.....
22115	Ryde's Cream Calf Meal. Ryde & Company, Chicago, Ill.	....	0.85	....	.....
22145	Mill Stream Boomerang Dairy Feed. Winchell Smith, Farmington, Conn.	5.62	1.23	....	.....
22075	Iowa Stock Feed. Purity Oats Co., Chicago, Ill.	....	0.59	....	.....
22140	Quisenberry "Big 4" Laying Mash. Quisenberry Feed Mfg. Co., Buffalo, N. Y.	....	....	1.65	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	OIL SEED PRODUCTS.	
	Cottonseed Meal.	
22011	Good. E. T. Allen Co., Atlanta, Ga.	*Waterbury.* Spencer Grain Co
		Guaranty
22187	Rainbow. American Oil Cake & Feed Co. Dallas, Texas	*New Haven:* R. G. Davis & Sons
		Guaranty
22135	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga	*Middletown:* Meech & Stoddard, Inc.
		Guaranty
22013	[1]Buckeye. Buckeye Cotton Oil Co., Cincinnati, Ohio	*West Cheshire:* G. W. Thorpe
		Guaranty
22004	Good. The Cameron-Daniel Co., Atlanta, Ga	*Seymour:* Seymour Grain & Coal Co.
		Guaranty
22066	Bull. Humphreys-Godwin Co., Memphis, Tenn	*New Milford:* Geo. T. Soule
		Guaranty
22049	Danish. Humphreys-Godwin Co., Memphis, Tenn	*Canaan:* Ives & Pierce
		Guaranty
22157	Lovit. L. B. Lovitt & Co., Memphis, Tenn	*Rockville:* Rockville Grain & Coal Co.
		Guaranty
22084	Thirty-six. L. B. Lovitt & Co., Memphis, Tenn	*Hamden:* I. W. Beers
		Guaranty
22149	Triangle. R. N. Neal & Co., Memphis, Tenn	*New Hartford:* Geo. W. Case
		Guaranty
22044	Prime Quality. Texas Refining Co., San Antonio, Texas	*Torrington:* Litch. Co. Co-op. Assn.
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Cottonseed Feed.	
22092	White Mule. Marianna Cotton Oil Co., Marianna, Ark	*Bristol:* Goodsell Bros
		Guaranty
	Linseed Meal, Old Process.	
22041	Amco. American Milling Co., Peoria, Ill	*Torrington:* D. L. Talcott
		Guaranty
21993	Archer Daniels Linseed Co., Edgewater, N. J.	*Derby:* Peterson-Hendee Co
		Guaranty
22176	[1] Kellogg & Miller, Amsterdam, N. Y.	*Danielson:* Quinnibaug Mills
		Guaranty
22010	Kellogg's. Kellogg & Sons, Buffalo, N. Y.	*Waterbury:* Spencer Grain Co
		Guaranty
22093	Argentine. Mann Bros. Co., Buffalo, N. Y.	*Bristol:* Goodsell Bros
		Guaranty
22186	Midland Linseed Products Co., Edgewater, N. J.	*New Haven:* R. G. Davis & Sons
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible

[1] Wire tags.

INSPECTION OF 1923.

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22011	6.82	5.95	36.25	11.87	31.95	7.16	$55.00
.....	....	....	36.00	14.00	....	5.50	.....
22187	7.58	5.82	36.38	12.03	31.82	6.37	54.00
.....	....	....	36.00	.....	....	5.00	.....
22135	6.92	5.57	34.50	13.33	34.15	5.53	54.00
.....	....	....	36.00	14.00	.....	5.50	.....
22013	6.68	6.30	36.00	12.09	33.14	5.79	53.00
.....	....	....	36.00	.....	.....	5.00	.....
22004	8.21	6.08	34.75	11.19	32.82	6.95	55.00
.....	....	....	36.00	14.00	.....	5.50	.....
22066	8.00	6.18	42.88	7.19	28.65	7.10	60.00
.....	....	....	43.00	10.00	.....	5.00	.....
22049	7.13	5.81	36.75	12.24	31.94	6.13	55.00
.....	....	....	36.00	15.00	.....	5.00	.....
22157	6.48	6.78	41.31	8.78	30.17	6.48	64.00
.....	....	....	41.00	10.00	.....	6.00	.....
22084	6.88	6.23	39.25	10.05	31.24	6.35	56.00
.....	....	....	36.00	14.00	.....	5.00	.....
22149	6.20	5.92	36.50	12.08	33.09	6.21	54.00
.....	....	....	36.00	14.00	.....	5.00	.....
22044	6.78	5.29	42.13	12.00	28.03	5.77	58.00
.....	....	....	43.00	12.00	.....	6.00	.....
.....	....	....	**37.73**	**13.00**	.....	**5.32**	.....
.....	**7.06**	**5.99**	**37.88**	**11.17**	**31.55**	**6.35**	**56.18**
.....	....	....	**32.7**	**4.1**	**23.7**	**6.0**	.....
22092	6.45	6.05	39.00	10.53	31.48	6.49	55.00
.....	....	....	36.00	14.00	28.50	5.00	.....
22041	8.53	5.90	30.44	8.78	39.84	6.51	53.00
.....	....	....	30.00	.....	....	5.00	.....
21993	8.88	6.03	33.19	6.98	37.71	7.21	58.00
.....	....	....	31.00	.....	.....	5.00	.....
22176	7.67	6.27	30.94	6.85	40.89	7.38	63.00
.....	....	....	30.00	9.00	.....	4.00	.....
22010	**7.45**	6.12	32.38	7.30	40.17	6.58	55.00
.....	....	....	31.00	.....	.....	5.00	.....
22093	8.61	5.95	31.69	7.44	37.90	8.41	58.00
.....	....	....	31.00	10.00	.....	6.00	.....
22186	7.04	6.17	32.50	7.33	40.04	6.92	54.00
.....	....	....	32.00	.....	.....	5.00	.....
.....	....	....	**30.83**	**9.50**	.....	**5.00**	.....
.....	**8.03**	**6.07**	**31.86**	**7.45**	**39.43**	**7.17**	**56.83**
.....	....	....	**28.4**	**4.3**	**30.8**	6.4	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	WHEAT PRODUCTS.	
	Wheat Bran.	
22125	Chas. M. Cox & Co., Boston, Mass.....	*East Haven:* F. A. Forbes.....
		Guaranty.....
22060	[2]Lucky. Federal Mill & Elevator Co., Lockport, N. Y.....	*Torrington:* F. L. Wadhams & Sons.
		Guaranty.....
21994	[2]Wm. Hamilton & Son, Inc., Honeoye Falls, N. Y.....	*Derby:* Peterson-Hendee Co.....
		Guaranty.....
22129	[2]Wm. Hamilton & Son, Inc., Honeoye Falls, N. Y.....	*Guilford:* Fred C. Morse.....
		Guaranty.....
22038	[2]Choice. Hecker-Jones-Jewell Milling Co., New York.....	*Waterbury:* H. S. Coe & Co.....
		Guaranty.....
22107	[2]Choice. Hecker-Jones-Jewell Milling Co., New York.....	*Meriden:* Meriden Grain & Coal Co..
		Guaranty.....
22102	[1, 2]Larabee Flour Mills Corp, Wellington, Kansas.....	*Wallingford:* A. E. Hall.....
		Guaranty.....
22117	[1, 2]Leavenworth Milling Co., Leavenworth, Kansas.....	*Granby:* E. H. Rollins.....
		Guaranty.....
22000	Niagara. Niagara Falls Milling Co., Niagara Falls, N. Y.....	*Ansonia:* Ansonia Flour & Grain Co.
		Guaranty.....
22062	Ogilvie Flour Mills Co., Fort William, Canada.....	*Litchfield:* Wadhams & Co.....
		Guaranty.....
22051	Bell Cow. Quaker Oats Co., Chicago, Ill.	*Canaan:* Ives & Pierce.....
		Guaranty.....
22190	Royal. Royal Milling Co., Great Falls, Mont.....	*New Haven:* Crittenden-Benham Co.
		Guaranty.....
22073	Occident. Russell Miller Milling Co., Minneapolis, Minn.....	*Danbury:* H. E. Meeker ....
		Guaranty.....
22114	Dakota Maid. State Mill & Elevator Co., Grand Forks, North Dakota.....	*Willimantic:* Willimantic Grain Co..
		Guaranty.....
22078	[2]Crescent. Star & Crescent Milling Co., Chicago, Ill.....	*Norwalk:* Francis H. Leggett & Co. .
		Guaranty.....
22019	St. Laurance Flour Milling Co., Montreal, Canada.....	*Southport:* C. Buckingham & Co....
		Guaranty.....
22032	[2]Angelus. Thompson Milling Co., Lockport, N. Y.....	*Stamford:* Francis H. Leggett & Co..
		Guaranty.....
22043	[2] Gold Medal. Washburn-Crosby Co., Minneapolis, Minn.....	*Torrington:* D. L. Talcott.....
		Guaranty.....
22008	Pioneer. Western Canada Flour Mills Co., Winnipeg, Canada.....	*Waterbury:* Spencer Grain Co.....
		Guaranty.....
		Average guaranty.....
		Average of analyses.....
		Average digestible.....
	Wheat Middlings.	
22124	C. M. Cox & Co., Boston, Mass.....	*East Haven:* F. A. Forbes.....
		Guaranty.....
22127	Wirthmore. C. M. Cox & Co., Boston, Mass.....	*Branford:* S. V. Osborn.....
		Guaranty.....

[1] Wire tags.
[2] With screenings.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22125	10.07	5.82	16.06	8.63	53.36	6.06	$38.00
.....	....	....	.....	.....	.....	....	....
22060	8.73	6.73	14.75	9.82	54.59	5.38	41.00
.....	....	....	15.00	.....	.....	4.00	.....
21994	9.96	6.45	15.25	8.06	56.02	4.26	42.00
.....	....	....	13.25	11.60	.....	2.90	....
22129	9.43	5.95	14.75	8.68	56.83	4.36	44.00
.....	....	....	13.25	11.60	.....	2.90	.....
22038	10.21	6.18	14.50	9.63	54.26	5.22	41.00
.....	....	....	13.00	.....	.....	3.50	.....
22107	9.35	6.76	15.75	9.23	53.64	5.27	42.00
.....	....	....	13.00	14.00	.....	3.50	.....
22102	9.61	6.47	15.88	8.66	54.52	4.86	37.00
.....	....	....	15.00	10.00	.....	3.50	.....
22117	10.35	6.65	15.63	8.16	54.91	4.30	39.00
.....	....	....	14.50	10.00	.....	3.60	.....
22000	9.56	5.93	16.25	8.32	54.92	5.02	39.00
.....	....	....	15.00	.....	.....	3.50	.....
22062	9.36	6.22	16.06	8.23	54.07	6.06	42.00
.....	....	....	14.00	.....	.....	3.00	.....
22051	9.05	5.62	15.75	9.60	54.29	5.69	42.00
.....	....	....	15.00	.....	.....	3.50	.....
22190	8.99	5.88	17.25	7.88	53.82	6.18	38.00
.....	....	....	15.00	.....	.....	3.00	.....
22073	9.42	6.44	16.13	8.73	53.49	5.79	42.00
.....	....	....	14.00	.....	.....	4.00	.....
22114	10.43	6.08	15.25	9.34	52.70	6.20	39.00
.....	....	....	14.00	.....	.....	5.00	.....
22078	10.24	6.68	14.88	9.06	54.50	4.64	42.00
.....	....	....	14.00	.....	.....	3.00	.....
22019	8.12	6.08	16.19	9.08	54.98	5.55	40.00
.....	....	....	15.00	.....	.....	3.50	.....
22032	10.73	6.55	15.25	9.17	53.58	4.72	42.00
.....	....	....	15.50	.....	.....	4.00	.....
22043	9.14	5.88	16.13	9.13	54.43	5.29	43.00
.....	....	....	14.00	.....	.....	4.00	.....
22008	10.06	6.23	15.88	8.98	53.00	5.85	41.00
.....	....	....	15.00	.....	.....	3.50	.....
.....	....	....	**14.31**	**11.44**	.....	**3.55**	.....
.....	**9.62**	**6.24**	**15.66**	**8.86**	**54.32**	**5.30**	**40.74**
.....	....	....	**12.2**	**2.7**	**39.1**	**3.6**	.....
22124	10.06	4.10	18.44	5.73	54.87	6.80	38.00
.....	....	....	.....	.....	.....	....	.....
22127	10.18	3.60	17.00	5.16	58.80	5.26	44.00
.....	....	....	14.00	8.00	.....	4.00	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	WHEAT PRODUCTS—*Concluded.*	
	Wheat Middlings—Concluded.	
22056	[2]Commander. Commander Milling Co., Minneapolis, Minn	*Winsted:* E. Manchester & Sons
		Guaranty
22130	[2]Dominion Flour Mills Co., Montreal, Canada	*Guilford:* Fred C. Morse
		Guaranty
22119	Elmore Red Dog Flour Middlings. Elmore Milling Co., Oneonta, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.
		Guaranty
22026	[2]H. Hecker-Jones-Jewell Milling Co., New York	*Stamford:* Francis H. Leggett & Co.
		Guaranty
22109	Niagara. Niagara Falls Milling Co., Niagara Falls, New York	*Meriden:* H. Grulich
		Guaranty
22100	[2]Northwestern Consolidated Milling Co., Minneapolis, Minn	*North Haven:* W. L. Thorpe
		Guaranty
22009	Bell Cow. Quaker Oats Co., Peterborough, Canada	*Waterbury:* Spencer Grain Co
		Guaranty
22017	A. H. Randall Milling Co., Tekonsha, Michigan	*West Cheshire:* G. W. Thorpe
		Guaranty
22111	[2]Dakota. State Mill. & Elevator Co., Grand Forks, North Dakota	*New Britain:* S. Svea Grain & Coal Co.
		Guaranty
21999	[2]Gold Medal. Washburn-Crosby Co., Minneapolis, Minn	*Ansonia:* Ansonia Flour & Grain Co.
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Feed (Mixed Feed)	
22110	[2]St. Paul Queen. Capitol City Milling & Grinding Co., St. Paul, Minn	*New Britain:* S. Svea Grain & Coal Co.
		Guaranty
22158	Boston. Duluth Superior Milling Co., Duluth, Minn	*Rockville:* Rockville Grain & Coal Co.
		Guaranty
22177	Durum. Duluth Superior Milling Co., Duluth, Minn	*Danielson:* Dayville Grain & Coal Co.
		Guaranty
22181	Dairy Maid. Federal Mill & Elevator Co., Lockport, N. Y.	*Putnam:* Bosworth Bros
		Guaranty
22099	[2]Northwestern Consolidated Milling Co., Minneapolis, Minn	*No. Haven.* W. L. Thorpe
		Guaranty
22005	[2]Fancy. Pillsbury Flour Mills, Minneapolis, Minn	*Seymour:* Seymour Grain & Coal Co.
		Guaranty
22072	Occident. Russell Miller Milling Co., Minneapolis, Minn	*Danbury:* H. E. Meeker
		Guaranty
22001	Gold Mine. Sheffield King Milling Co., Minneapolis, Minn	*Ansonia:* Ansonia Flour & Grain Co.,
		Guaranty
22047	[2]Syragold. Syracuse Milling Co., Syracuse, N. Y.	*Norfolk:* Aug. P. Curtis
		Guaranty
22059	[2]Gold Medal. Washburn-Crosby Mills, Minneapolis, Minn	*Torrington:* F. L. Wadhams & Sons.
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible

[2] With Screenings.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22056	10.32	4.48	17.13	6.73	56.09	5.25	$45.00
.....	....	....	16.50	.....	.....	5.00	.....
22130	9.58	4.61	17.63	7.35	54.58	6.25	44.00
.....	....	....	16.00	.....	.....	5.00	.....
22119	10.67	3.05	15.94	3.69	62.18	4.47	49.00
.....	....	....	15.00	6.00	.....	4.00	.....
22026	7.78	4.66	16.81	8.08	57.63	5.04	.....
.....	....	....	14.00	9.50	.....	5.00	.....
22109	9.07	4.13	17.31	6.21	57.70	5.58	44.00
.....	....	....	15.50	.....	.....	4.00	.....
22100	9.23	3.78	17.06	5.38	58.97	5.58	45.00
.....	....	....	15.00	.....	.....	4.00	.....
22009	8.59	3.94	17.50	5.94	57.82	6.21	41.00
.....	....	....	16.00	8.00	.....	4.00	.....
22017	7.64	4.96	18.13	6.35	58.40	4.52	42.00
.....	....	....	13.00	12.00	.....	3.00	.....
22111	10.45	3.83	17.63	5.31	56.89	5.89	44.00
.....	....	....	16.10	....	.....	5.70	.....
21999	9.69	4.55	17.06	6.72	56.68	5.30	39.00
.....	....	....	15.00	.....	.....	4.00	.....
.....	....	....	**15.10**	**8.70**	.....	**4.34**	.....
.....	**9.44**	**4.14**	**17.30**	**6.05**	**57.56**	**5.51**	**43.18**
.....	....	....	**13.3**	**1.8**	**44.9**	**4.8**	.....
22110	9.47	3.65	15.69	6.75	58.61	5.83	44.00
.....	....	....	15.70	.....	.....	4.60	.....
22158	8.51	5.30	16.25	7.97	56.22	5.75	44.00
.....	....	....	15.00	.....	.....	3.50	.....
22177	9.31	4.59	16.63	7.24	56.00	6.23	36.00
.....	....	....	15.00	.....	.....	5.00	.....
22181	8.40	5.28	15.75	7.05	58.77	4.75	42.00
.....	....	....	13.00	.....	.....	4.00	.....
22099	9.03	4.73	16.25	7.10	57.11	5.78	43.00
.....	....	....	15.00	.....	.....	4.00	.....
22005	10.36	4.10	16.50	5.16	59.27	4.61	43.00
.....	....	....	15.00	.....	.....	4.00	.....
22072	9.53	5.13	17.25	7.25	54.99	5.85	44.00
.....	....	....	15.00	.....	.....	4.00	.....
22001	9.26	5.20	15.13	8.23	56.87	5.31	40.00
.....	....	....	15.00	.....	.....	4.50	.....
22047	8.98	4.63	16.63	7.42	56.56	5.78	41.00
.....	....	....	15.00	10.00	.....	4.00	.....
22059	9.79	5.02	16.44	6.31	58.03	4.41	45.00
.....	....	....	16.00	.....	.....	4.00	.....
.....	.....	.....	**14.97**	.....	.....	**4.16**	.....
.....	**9.26**	**4.76**	**16.25**	**7.05**	**57.25**	**5.43**	**42.20**
.....	.....	....	**12.5**	**2.5**	**43.5**	**4.7**	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	RYE PRODUCTS.	
22103	Choice Rye Middlings. Miner-Hillard Mill. Co., Wilkes-Barre, Pa	*Wallingford:* A. E. Hall
		Guaranty
22042	Gold Medal Rye Middlings. Washburn-Crosby Co., Minneapolis, Minn	*Torrington:* D. L. Talcott
		Guaranty
	WHEAT AND RYE PRODUCTS.	
22055	Palmo Midds. Newsome Feed and Grain Co., Pittsburgh, Pa	*Winsted:* E. Manchester & Sons
		Guaranty
	BUCKWHEAT PRODUCTS.	
22123	[3]Buckwheat Offal Feed. Larrowe Buckwheat Flour Corp., Cohocton, N. Y.	*East Haven:* F. A. Forbes
		Guaranty
22148	Buckwheat Middlings. Winchell Smith, Farmington, Conn	*Farmington:* Winchell Smith
		Guaranty
	OAT PRODUCTS.	
22160	Corno Oat Feed. Corno Mills Co., East St. Louis, Ill	*Rockville:* Rockville Grain & Coal Co.
		Guaranty
22053	Oat Middlings. Armour Grain Co., Chicago, Ill	*Winsted:* E. Manchester & Sons
		Guaranty
	MAIZE PRODUCTS.	
	Corn Gluten Feed.	
22163	Clinton. Clinton Corn Syrup Refining Co., Clinton, Iowa	*New London:* P. Schwartz Co
		Guaranty
22089	Buffalo. Corn Products Refining Co., New York	*Plantsville:* C. A. Cowles
		Guaranty
22083	KKK. J. C. Hubinger Bros Co., Keokuk, Iowa	*Hamden:* I. W. Beers
		Guaranty
22061	Douglas. Penick & Ford, Ltd., Inc., Grand Rapids, Mich	*Litchfield:* Wadhams & Co
		Guaranty
21995	Staley's. A. E. Staley Mfg. Co., Decatur, Ill	*Derby:* Peterson-Hendee Co
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Corn Gluten Meal.	
22170	Diamond. Corn Products Refining Co., New York	*Westerly:* C. W. Campbell Co
		Guaranty
	Hominy Feed.	
22030	Acme. Acme Evans Co., Indianapolis, Ind	*Stamford:* Francis H. Leggett & Co.
		Guaranty
22022	[4]Akron Feed & Milling Co., Akron, Onio	*So. Norwalk:* Roodner Feed Co
		Guaranty
22054	Homco. American Hominy Co., Indianapolis, Ind	*Winsted:* E. Manchester & Sons
		Guaranty
22045	Yellow. Armour Grain Co., Chicago, Ill.	*Torrington:* Litch. Co. Coop. Assoc.
		Guaranty

[3] Contains middlings, hulls and screenings from buckwheat.
[4] Statement of dealer. No tags.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22103	10.40	3.15	14.63	3.31	65.53	2.98	$41.00
.....	....	....	12.00	5.00	.....	2.50	.....
22042	9.30	4.57	14.94	6.06	61.62	3.51	41.00
.....	....	....	14.00	.....	.....	3.00	.....
22055	6.27	5.07	16.69	6.00	58.69	7.28	36.00
.....	....	....	16.00	9.00	....	7.00	.....
22123	8.89	4.03	10.13	18.09	54.84	4.02	41.00
.....	....	....	10.00	30.00	.....	2.25	.....
22148	10.46	2.76	15.81	5.00	61.79	4.18	45.00
.....	....	....	.....	.....	.....	....	.....
22160	4.78	6.23	7.88	22.57	56.13	2.41	25.00
.....	....	....	6.00	28.00	.....	2.00	.....
22053	6.45	3.20	16.63	5.94	61.68	6.10	47.00
.....	....	....	15.00	10.00	.....	5.00	.....
22163	8.29	3.64	25.25	5.72	53.81	3.29	53.00
.....	....	....	23.00	.....	.....	2.00	.....
22089	7.77	4.83	26.25	6.65	49.44	5.06	55.00
.....	....	....	23.00	.....	.....	1.00	.....
22083	8.59	2.03	22.75	6.62	56.40	3.61	53.00
.....	....	....	23.00	.....	.....	1.00	.....
22061	7.77	4.03	29.06	5.49	50.49	3.16	57.00
.....	....	....	23.00	.....	.....	1.00	.....
21995	8.88	4.77	27.69	4.97	52.03	1.66	58.00
.....	....	....	23.00	.....	.....	1.00	.....
.....	....	....	**23.00**	.....	.....	**1.20**	.....
.....	**8.26**	**3.86**	**26.20**	**5.89**	**52.43**	**3.36**	**55.20**
.....	....	....	**22.3**	**4.5**	**46.1**	**2.9**	.....
22170	8.62	1.04	42.19	2.19	43.02	2.94	66.00
.....	....	....	40.00	.....	.....	1.00	.....
22030	10.56	1.95	10.63	3.23	67.67	5.96	50.00
.....	....	....	10.00	6.00	.....	7.00	.....
22022	7.22	2.51	11.88	4.23	66.34	7.82	47.00
.....	....	....	.....	.....	.....	....	.....
22054	8.29	2.17	10.25	4.28	68.14	6.87	49.00
.....	....	....	10.00	6.00	.....	6.00	.....
22045	10.47	2.57	11.13	4.27	64.49	7.07	49.00
.....	....	....	9.50	5.00	.....	5.00	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	MAIZE PRODUCTS—*Concluded.*	
	Hominy Feed—Concluded.	
22014	Aunt Jemima Mills Co., St. Joseph, Mo. .	*West Cheshire:* G. W. Thorpe . . . . .
		Guaranty . . . . .
22162	Paragon. Chas. M. Cox, Boston, Mass.	*Chester:* Leet Bros . . . . .
		Guaranty . . . . .
22118	Emco. Evans Milling Co., Indianapolis, Ind	*Suffield:* Spencer Bros . . . . .
		Guaranty . . . . .
22172	The Forbes Milling Co., Topeka, Kansas. .	*Norwich:* Yantic Grain & Products Co.
		Guaranty . . . . .
22120	Badger. Chas. A. Krause Milling Co., Milwaukee, Wis	*Thompsonville:* Geo. S. Phelps & Co. .
		Guaranty . . . . .
22002	Sonny South. Louisville Milling Co., Louisville, Ky	*Seymour:* Seymour Grain & Coal Co. .
		Guaranty . . . . .
22133	Choice Steam Cooked. Miner-Hillard Milling Co., Wilkes-Barre, Pa	*Middlefield:* Middlefield Gr. & Cl. Co.
		Guaranty . . . . .
22175	[1]Patent Cereals Co., Geneva, N. Y.	*Moosup:* T. E. Main & Sons . . . . .
		Guaranty . . . . .
22007	Pure. Plymouth Milling Co., Lemars, Iowa	*Waterbury:* Spencer Grain Co . . . . .
		Guaranty . . . . .
22048	Burt's. Postum Cereal Co., Inc., Battle Creek, Mich	*Norfolk:* Aug. P. Curtis . . . . .
		Guaranty . . . . .
22039	Yellow. Quaker Oats Co., Chicago, Ill. .	*Waterbury:* H. S. Coe & Co. . . . .
		Guaranty . . . . .
22126	White. Quaker Oats Co., Peterborough, Canada	*Branford:* S. V. Osborn . . . . .
		Guaranty . . . . .
		Average guaranty . . . . .
		Average of analyses . . . . .
		Average digestible . . . . .
	BREWER'S PPODUCTS.	
22067	Bull. Farmers' Feed Co., New York City	*New Milford:* Geo. T. Soule . . . . .
		Guaranty . . . . .
22153	Dried Grains. Dawes Brewery, Montreal, Quebec	*Hazardville:* A. D. Bridges' Sons. . . .
		Guaranty . . . . .
	DRIED BEET PULP.	
22028	Great Western Sugar Co., Denver, Col. .	*Stamford:* Francis H. Leggett & Co. .
		Guaranty . . . . .
22132	Great Western Sugar Co., Denver, Col. .	*Middlefield:* Middlefield Gr. & Cl. Co.
		Guaranty . . . . .
22137	Great Western Sugar Co., Denver, Col. .	*Middletown:* Meech & Stoddard, Inc.
		Guaranty . . . . .
21997	Larrowe Milling Co., Detroit, Mich. . . .	*Derby:* Peterson-Hendee Co. . . . .
		Guaranty . . . . .
22154	Mich. Sugar Co., Saginaw, Mich	*Hazardville:* A. D. Bridges Sons. . . .
		Guaranty . . . . .
		Average guaranty . . . . .
		Average of analyses . . . . .
		Average digestible . . . . .

[1] Wire tags.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22014	9.72	2.28	10.25	5.73	66.04	5.98	$48.00
	....	....	10.00	6.00	.....	5.00	.....
22162	9.39	2.39	10.50	3.43	67.92	6.37	49.00
	....	....	9.50	7.00	.....	7.50	.....
22118	9.72	2.53	10.81	4.19	65.18	7.57	49.00
	....	....	10.00	7.00	.....	7.50	.....
22172	6.18	2.70	11.00	5.61	65.83	8.68	45.00
	....	....	10.00	7.00	.....	8.00	.....
22120	10.42	1.80	10.75	2.93	69.37	4.73	48.00
	....	....	10.00	.....	.....	5.00	.....
22002	8.78	2.90	11.50	5.30	65.42	6.10	47.00
	....	....	10.00	6.00	.....	7.00	.....
22133	9.46	2.35	10.75	3.88	68.21	5.35	45.00
	....	....	10.00	5.00	.....	4.00	.....
22175	9.60	2.68	10.81	3.97	68.26	4.68	41.00
	....	....	10.00	5.00	.....	5.00	.....
22007	7.77	2.29	11.19	4.08	67.31	7.36	49.00
	....	....	10.00	4.80	.....	6.30	.....
22048	8.62	2.68	11.63	4.86	65.67	6.54	46.00
	....	....	10.00	5.00	.....	6.00	.....
22039	8.89	2.30	11.38	3.61	67.99	5.83	48.00
	....	....	10.50	6.00	.....	5.00	.....
22126	7.57	2.03	10.94	3.15	69.95	6.36	46.00
	....	....	10.50	5.00	.....	6.00	.....
	....	....	**10.00**	**5.77**	.....	**6.02**	.....
	8.92	**2.38**	**10.96**	**4.17**	**67.11**	**6.45**	**47.25**
	....	....	**7.2**	**3.2**	**60.4**	**5.9**	.....
22067	4.58	4.03	20.88	16.22	46.47	7.82	50.00
	....	....	22.00	.....	.....	6.00	.....
22153	5.71	3.67	23.88	12.16	46.41	8.17	52.00
	....	....	21.00	19.58	.....	6.25	.....
22028	8.06	5.69	8.75	18.43	58.15	0.92	51.00
	....	....	8.00	20.00	.....	0.50	.....
22132	7.12	3.08	8.50	19.58	61.09	0.63	49.00
	....	....	8.00	22.00	.....	....	.....
22137	4.30	7.97	9.00	14.21	64.14	0.38	44.00
	....	....	8.00	.....	.....	0.50	.....
21997	10.14	3.26	9.63	17.87	57.69	1.41	46.00
	....	....	8.00	20.00	.....	0.50	.....
22154	6.60	2.93	9.50	19.32	61.04	0.61	51.00
	....	....	8.00	20.00	.....	0.50	.....
	....	....	**8.00**	**20.50**	.....	**0.50**	.....
	7.24	**4.59**	**9.08**	**17.88**	**60.42**	**0.79**	**48.20**
	....	....	**4.7**	**14.8**	**50.1**	....	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS.	
	Horse, Dairy and Stock Feeds.	
22021	Portage Stock Feed. Akron Feed & Milling Co., Akron, Ohio	*So. Norwalk:* Roodner Feed Co
		Guaranty
21998	Sunshine Dairy Feed. Ansonia Flour and Grain Co., Ansonia, Conn	*Ansonia:* Ansonia Flour & Grain Co.
		Guaranty
22033	Armour's Steam Cooked Feed. Armour Grain Co., Chicago, Ill	*Stamford:* W. L. Crabb
		Guaranty
22167	Favorite Dairy Ration. E. W. Bailey & Co., Swanton, Vt	*Mystic:* Mystic Grain Co
		Guaranty
22166	Pennant Brand Stock Feed. E. W. Bailey & Co., Swanton, Vt	*Mystic:* Mystic Grain Co
		Guaranty
22138	Blatchford's Calf Meal. Blatchford Calf Meal Co., Waukegan, Ill	*Middletown:* Meech & Stoddard, Inc.
		Guaranty
22179	Parex Stock Feed. Bosworth Bros, Putnam, Conn	*Putnam:* Bosworth Bros
		Guaranty
22146	Direct Dairy Feed. Thomas-Boyce Feed Co., Attica, N. Y	*Farmington:* Winchell Smith
		Guaranty
22147	Direct Stock Feed. Thomas-Boyce Feed Co., Attica, N. Y	*Farmington:* Winchell Smith
		Guaranty
22164	Nobotheration Dairy Feed. C. W. Campbell Co., Westerly, R. I	*Mystic:* J. L. Manning & Co
		Guaranty
22168	Nobotheration Stock Feed. C. W. Campbell Co., Westerly, R. I	*Westerly:* C. W. Campbell Co
		Guaranty
22128	Paragon Dairy Feed. Chas. M. Cox Co., Boston, Mass	*Branford:* S. V. Osborn
		Guaranty
22015	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass	*West Cheshire:* G. W. Thorpe
		Guaranty
22068	Wirthmore Balanced Ration for Milch Cows. Chas. M. Cox Co., Boston, Mass.	*Danbury:* F. C. Benjamin
		Guaranty
22069	Ajax Dairy Ration. Chapin & Co., Hammond, Ind	*Danbury:* F. C. Benjamin
		Guaranty
22088	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind	*Plantsville:* C. A. Cowles
		Guaranty
22098	Advanced Registry Dairy Feed. Clover Leaf Milling Co., Buffalo, N. Y	*North Haven:* W. L. Thorpe
		Guaranty
22101	Clover Leaf Stock Feed. Clover Leaf Milling Co., Buffalo, N. Y	*North Haven:* W. L. Thorpe
		Guaranty
22027	Fortune Stock Feed. Coles Company, Middletown, Conn	*Stamford:* Francis H. Leggett & Co.
		Guaranty
22074	Basic Dairy Ration. R. G. Davis & Sons, New Haven, Conn	*Southford:* H. R. Stone
		Guaranty
22185	Davis Stock Feed. R. G. Davis & Sons, New Haven, Conn	*New Haven:* R. G. Davis & Sons
		Guaranty
22094	Delaware Dairy Feed. Delaware Mills, Deposit, N. Y	*Plainville:* Eaton Bros
		Guaranty
22079	Milkmore Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass	*New Canaan:* C. H. Fairty Co
		Guaranty
22096	Fitting Ration. Eastern States Farmers' Exchange, Springfield, Mass	*Farmington:* C. E. Stephenson
		Guaranty

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22021	6.09	3.97	8.25	11.41	66.78	3.50	$44.00
.....	....	....	8.50	10.00	.....	4.00	.....
21998	9.19	5.22	20.50	7.11	52.56	5.42	53.00
.....	....	....	20.00	9.00	.....	5.00	.....
22033	8.27	5.66	10.94	10.88	59.29	4.96	41.00
.....	....	....	9.00	.....	.....	4.00	.....
22167	7.33	4.08	23.13	5.82	54.23	5.41	50.00
.....	....	....	18.00	9.50	.....	4.50	.....
22166	7.20	3.63	9.88	9.31	63.46	6.52	44.00
.....	....	....	9.00	12.00	.....	5.00	.....
22138	9.39	6.00	24.13	6.03	49.65	4.80	96.00
.....	....	....	24.00	.....	.....	5.00	.....
22179	7.79	4.54	10.00	10.26	62.84	4.57	47.00
.....	....	....	9.00	.....	.....	3.00	.....
22146	8.28	4.87	24.00	7.84	50.15	4.86	55.00
.....	....	....	24.00	10.00	.....	5.00	.....
22147	7.78	3.90	10.94	11.24	63.57	2.57	41.00
.....	....	....	10.00	12.75	.....	4.00	.....
22164	8.59	3.87	26.13	6.08	49.88	5.45	49.00
.....	....	....	20.00	9.00	.....	4.00	.....
22168	7.88	4.03	11.75	10.65	62.31	3.38	42.00
.....	....	....	10.00	14.00	.....	5.00	.....
22128	7.45	5.09	21.63	11.17	49.90	4.76	50.00
.....	....	....	22.00	14.00	.....	4.00	.....
22015	6.26	3.63	9.50	10.35	63.66	6.60	46.00
.....	....	....	9.00	9.50	.....	4.00	.....
22068	8.17	4.88	26.63	7.84	46.62	5.86	54.00
.....	....	....	25.00	.....	.....	5.50	.....
22069	7.51	6.03	21.00	7.64	51.72	6.10	54.00
.....	....	....	20.00	.....	.....	5.00	.....
22088	8.57	6.01	25.25	7.20	47.04	5.93	55.00
.....	....	....	24.00	.....	.....	5.00	.....
22098	8.10	4.50	25.19	7.62	48.80	5.79	57.00
.....	....	....	25.00	10.00	.....	5.00	.....
22101	8.65	3.30	10.25	9.79	63.74	4.27	46.00
.....	....	....	9.00	.....	.....	3.50	.....
22027	5.81	3.99	8.31	13.52	63.97	4.40	.....
.....	....	....	7.00	.....	.....	3.00	.....
22074	9.54	5.57	20.19	7.26	52.69	4.75	49.00
.....	....	....	20.00	9.00	.....	5.00	.....
22185	7.61	5.40	8.63	14.62	61.53	2.21	39.00
.....	....	....	10.50	.....	.....	4.00	.....
22094	9.01	4.84	23.38	8.11	49.60	5.06	56.00
.....	....	....	23.00	.....	.....	4.00	.....
22079	9.28	5.30	25.88	6.65	48.78	4.11	56.00
.....	....	....	24.00	9.00	.....	5.00	.....
22096	9.26	4.59	17.00	6.40	58.20	4.55	.....
.....	....	....	12.00	8.00	.....	3.50	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
22097	Fulpail Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass..	*Farmington:* C. E. Stephenson.....
		Guaranty.....
22192	Fulpail Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass..	*Middletown:* Arthur Congdon.....
		Guaranty.....
22193	Fulpail Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass..	*Newtown:* Benjamin Bernstein.....
		Guaranty.....
22155	Elmore Horse Feed. Elmore Milling Co., Oneonta, N. Y.....	*Somers:* W. C. Everitt.....
		Guaranty.....
22121	Elmore Milk Grains. Elmore Milling Co., Oneonta, N. Y.....	*Thompsonville:* Geo. S. Phelps & Co.
		Guaranty.....
22070	Eshelman's 16% Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa.....	*Danbury:* F. C. Benjamin.....
		Guaranty.....
22003	Eshelman's 20% Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa.....	*Seymour:* Seymour Grain & Coal Co.
		Guaranty.....
22104	Eshelman's 8.5% Horse Feed. John W. Eshelman & Sons, Lancaster, Pa.....	*Wallingford:* A. E. Hall.....
		Guaranty.....
22112	Grandin's 24% Balanced Dairy Ration. D. H. Grandin Milling Co., Jamestown, N. Y.	*Willimantic:* Willimantic Grain Co...
		Guaranty.....
22171	Grandin's Stock Feed. D. H. Grandin Milling Co., Jamestown, N. Y.....	*Norwich:* Norwich Grain Co.....
		Guaranty.....
22182	Twin Six Dairy Feed. D. H. Grandin Milling Co., Jamestown, N. Y.....	*Willimantic:* Willimantic Grain Co...
		Guaranty.....
22018	Century Horse Feed. Dwight Hamlin, Inc., Pittsburgh, Pa.....	*Southport:* C. Buckingham & Co.....
		Guaranty.....
22023	Algrane Milk Feed. H-O Cereal Co., Inc., Buffalo, N. Y.....	*South Norwalk:* Roodner Feed Co...
		Guaranty.....
22165	New England Stock Feed. H-O Cereal Co., Buffalo, N. Y.....	*Mystic:* J. L. Manning & Co.....
		Guaranty.....
22091	Imperial Steam Cooked Feed. Imperial Grain and Mill Co., Toledo, Ohio.....	*Bristol:* Goodsell Bros.....
		Guaranty.....
22024	Kramco Dairy Ration. Chas. A. Krause Milling Co., Milwaukee, Wis.....	*South Norwalk:* Roodner Feed Co...
		Guaranty.....
22064	Larro Ready Ration. Larrowe Milling Co., Detroit, Mich.....	*New Milford:* Geo. E. Ackley & Co..
		Guaranty.....
22052	Bull Dairy Ration. Maritime Milling Co. Buffalo, N. Y.....	*Canaan:* Ives & Pierce.....
		Guaranty.....
22058	Red Star Dairy Feed. E. Manchester & Sons, Winsted, Conn.....	*Winsted:* E. Manchester & Sons.....
		Guaranty.....
22136	Barford's Balanced Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn...	*Middletown:* Meech & Stoddard, Inc.
		Guaranty.....
22108	Red Wing Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.....	*Meriden:* Meriden Grain & Coal Co..
		Guaranty.....
22131	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.....	*Middlefield:* Middlefield Gr. & Cl. Co.
		Guaranty.....
22183	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.....	*Hartford:* Meech Grain Co.....
		Guaranty.....

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22097	8.78	4.84	22.81	8.07	51.14	4.36	$48.94
.....	....	....	20.00	9.00	.....	4.50	.....
22192	5.12	9.28	22.13	6.47	52.81	4.19	48.94
.....	....	....	20.00	9.00	.....	4.00	.....
22193	9.16	5.63	22.63	7.43	50.10	5.05	48.00
.....	....	....	20.00	9.00	.....	4.50	.....
22155	8.34	3.80	19.00	11.90	63.88	3.08	43.00
.....	....	....	9.00	14.00	.....	3.00	.....
22121	8.73	6.03	24.44	7.94	47.71	5.15	55.00
.....	....	....	25.00	11.00	.....	6.00	.....
22070	7.16	6.46	21.19	11.81	47.78	5.60	45.00
.....	....	....	16.00	.....	.....	3.00	.....
22003	8.77	6.94	19.63	10.04	49.76	4.86	48.00
.....	....	....	20.00	.....	.....	4.00	.....
22104	5.86	3.76	12.19	7.81	66.09	4.29	50.00
.....	....	....	9.00	.....	.....	3.00	.....
22112	9.23	5.05	24.00	7.42	48.44	5.86	55.00
.....	....	....	24.00	.....	.....	5.00	.....
22171	7.50	3.42	9.50	8.78	65.55	5.25	46.00
.....	....	....	9.00	.....	.....	5.00	.....
22182	7.69	5.22	22.25	8.03	51.36	5.45	53.00
.....	....	....	22.00	.....	.....	5.00	.....
22018	4.45	8.14	8.25	9.67	7.47	2.02	37.00
.....	....	....	6.00	10.00	.....	2.00	.....
22023	6.91	5.39	17.50	11.33	55.50	3.37	49.00
.....	....	....	16.00	15.00	.....	4.00	.....
22165	8.54	5.05	12.81	6.86	61.97	4.77	44.00
.....	....	....	9.50	.....	.....	4.00	.....
22091	8.41	2.17	11.25	4.01	69.46	4.70	57.00
.....	....	....	9.00	.....	.....	4.00	.....
22024	6.73	5.35	21.63	9.55	51.55	5.19	54.00
.....	....	....	20.00	.....	.....	4.00	.....
22064	8.49	5.40	20.63	10.52	50.71	4.25	56.00
.....	....	....	20.00	.....	.....	4.00	.....
22052	7.37	7.39	25.13	9.79	44.36	5.96	54.00
.....	....	....	24.00	.....	.....	5.00	.....
22058	7.82	4.96	20.13	6.96	53.80	6.33	52.00
.....	....	....	23.00	10.00	.....	4.00	.....
22136	7.41	4.41	20.13	7.15	54.19	6.71	51.00
.....	....	....	19.00	.....	.....	5.50	.....
22108	7.64	4.07	20.13	7.05	55.13	5.98	57.00
.....	....	....	24.00	9.00	.....	6.00	.....
22131	7.54	5.47	17.88	6.93	56.91	5.27	51.00
.....	....	....	20.00	.....	.....	6.00	.....
22183	7.19	5.42	18.19	7.66	56.16	5.38	52.00
.....	..	....	20.00	.....	.....	6.00	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
22134	Red Wing Stock Feed. Meech & Stoddard, Inc., Middletown, Conn.	*Middlefield:* Middlefield Gr. & Cl. Co.
21996	Victory Horse Feed. Metropolitan Mills, Hoboken, N. J.	Guaranty *Derby:* Peterson-Hendee Co
22122	Mystic Stock Feed. Mystic Milling Co., Rochester, N. Y.	Guaranty *Thompsonville:* Geo. S. Phelps & Co.
22037	Uncle John's 24% Cream Pot Ration. Ontanio Milling Co., Oswego, N. Y.	Guaranty *Waterbury:* H. S. Coe & Co
22174	Bison Stock Feed. Park & Pollard Co., Boston, Mass	Guaranty *Colchester:* P. Cutler
22012	Stevens Mil Kade Calf Meal. Park & Pollard, Boston, Mass.	Guaranty *Waterbury:* Spencer Grain Co
22050	Pillsbury's Dairy Ration. Pillsbury Mills, Minneapolis, Minn	Guaranty *Canaan:* Ives & Pierce
22116	Pillsbury's Dairy Ration. Pillsbury Mills, Minneapolis, Minn	Guaranty *Granby:* E. H. Rollins
22031	Purina Cow Chow Feed. Purina Mills, St. Louis, Mo	Guaranty *Stamford:* Francis H. Leggett & Co.
22076	Protena Dairy Feed. Purina Mills, St. Louis, Mo.	Guaranty *Norwalk:* Francis H. Leggett & Co.
22159	Purina Pig Chow. Purina Mills, St. Louis Mo	Guaranty *Rockville:* Rockville Grain & Coal Co.
22075	Iowa Stock Feed. Purity Oats Co., Chicago, Ill.	Guaranty *Norwalk:* Francis H. Leggett & Co.
22085	Big Q Dairy Ration. Quaker Oats Co., Chicago, Ill	Guaranty *Hamden:* I. W. Beers
22040	Schumacher's Sugared Feed. Quaker Oats Co., Chicago, Ill	Guaranty *Waterbury:* H. S. Coe & Co
22188	Schumacher's Feed. Quaker Oats Co., Chicago, Ill	Guaranty *New Haven:* R. G. Davis & Sons
22077	White Star Fine Feed. Quaker Oats Co., Chicago, Ill	Guaranty *Norwalk:* Francis H. Leggett & Co.
22161	Rosebro Horse Feed. Rosenbaum Bros., Chicago, Ill.	Guaranty *Chester:* Leet Bros
22115	Ryde's Cream Calf Meal. Ryde & Company, Chicago, Ill	Guaranty *Willimantic:* Willimantic Grain Co.
22144	Honest Hog Feed. Winchell Smith, Farmington, Conn	Guaranty *Farmington:* Winchell Smith
22145	Mill Stream Boomerang Dairy Feed. Winchell Smith, Farmington, Conn	Guaranty *Farmington:* Winchell Smith
22046	Syragold Dairy Feed. Syracuse Milling Co., Syracuse, N. Y.	Guaranty *Norfolk:* Aug. P. Curtis
22095	Syragold Stock Feed. Syracuse Milling Co., Syracuse, N. Y.	Guaranty *Plainville:* Eaton Bros
22016	Red Brand Ti-O-Ga Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	Guaranty *West Cheshire:* G. W. Thorpe
22082	White Brand Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	Guaranty *New Canaan:* C. H. Fairty Co
		Guaranty

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, (etc.)	Ether Extract (Crude fat)	
22134	7.34	5.00	9.69	9.47	63.30	5.20	$46.00
.....	....	....	9.00	7.00	.....	3.00	.....
21996	7.74	6.55	8.50	11.17	64.56	1.48	48.00
.....	....	....	8.00	15.00	.....	1.00	.....
22122	8.67	4.27	14.19	7.50	60.85	4.52	43.00
.....	....	....	9.00	....	.....	3.00	.....
22037	8.49	5.41	23.50	7.96	48.58	6.06	55.00
.....	....	....	24.00	.....	.....	5.50	.....
22174	7.43	6.50	8.25	13.45	61.91	2.46	44.00
.....	....	....	8.00	.....	.....	2.00	.....
22012	7.92	7.12	20.38	5.40	52.33	6.85	89.00
.....	....	....	20.00	.....	.....	3.00	.....
22050	7.99	7.05	20.44	8.78	50.33	5.41	51.00
.....	....	....	20.00	11.00	.....	4.00	.....
22116	8.37	7.61	20.13	7.82	50.70	5.37	47.00
.....	....	....	20.00	.....	.....	4.00	.....
22031	8.66	6.60	24.31	11.44	43.78	5.21	63.00
.....	....	....	24.00	.....	.....	4.30	.....
22076	8.55	6.55	17.38	11.66	51.58	4.28	45.00
.....	....	....	16.50	.....	.....	3.50	.....
22159	7.81	6.72	20.50	6.94	53.05	4.98	69.00
.....	....	....	20.00	.....	.....	3.20	.....
22075	7.54	3.90	9.88	10.50	63.27	4.91	43.00
.....	....	....	10.00	12.00	.....	5.50	.....
22085	8.25	5.44	23.00	9.94	48.53	4.84	54.00
.....	....	....	21.00	.....	.....	4.00	.....
22040	7.72	4.79	10.63	10.34	61.95	4.57	45.00
.....	....	....	10.00	.....	.....	3.25	.....
22188	7.51	4.10	10.00	11.15	63.41	3.83	44.00
.....	....	....	10.00	.....	.....	3.25	.....
22077	8.09	4.41	7.88	12.53	63.88	3.21	40.00
.....	....	....	8.00	.....	.....	3.00	.....
22161	7.35	3.10	10.94	6.85	67.23	4.53	48.00
.....	....	....	10.00	.....	.....	2.00	.....
22115	8.84	6.20	25.00	4.91	50.90	4.15	95.00
.....	....	....	25.00	.....	.....	5.00	.....
22144	8.78	6.13	16.88	3.54	59.86	4.81	45.00
.....	....	....	.....	.....	.....	....	.....
22145	7.79	4.86	17.38	9.19	56.01	4.77	52.00
.....	....	....	23.00	.....	.....	6.00	.....
22046	8.01	4.87	24.88	8.86	48.00	5.38	54.00
.....	....	....	24.00	.....	.....	4.50	.....
22095	2.95	5.07	10.44	10.61	66.52	4.41	43.00
.....	....	....	9.00	12.00	.....	3.00	.....
22016	7.11	6.61	25.00	9.14	46.63	5.51	53.00
.....	....	....	24.00	10.00	.....	4.50	.....
22082	9.14	6.44	21.75	5.84	51.27	5.56	55.00
.....	....	....	20.00	10.00	.....	4.50	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Concluded.	
22087	Biles Ready Dairy Ration. Ubiko Milling Co., Cincinnati, Ohio	*Plantsville:* C. A. Cowles Guaranty
22173	Red Tag Big Y Stock Feed. The Yantic Grain & Products Co., Norwich, Conn.	*Norwich:* Yantic Grain & Products Co. Guaranty
	Poultry Feeds.	
22063	Cak-Cak Laying Mash. Armour Grain Co., Chicago, Ill	*New Milford:* Geo. E. Ackley & Co. Guaranty
22034	Iroquois Poultry Mash. Armour Grain Co., Chicago, Ill	*Stamford:* W. L. Crabb Guaranty
22036	Basic Laying Mash No. 93. Basic Feeds Co., Lockport, Ill	*Stamford:* W. L. Crabb Guaranty
22180	Parex Dry Mash. Bosworth Bros., Putnam, Conn	*Putnam:* Bosworth Bros Guaranty
22142	Servus Egg Mash, With Milk. Thomas-Boyce, Attica, N. Y	*Farmington:* Winchell Smith Guaranty
22169	Egg Dry Mash. C. W. Campbell Co., Westerly, R. I	*Westerly:* C. W. Campbell Co Guaranty
22143	Peerless Laying Mash. Clover Leaf Milling Co., Buffalo, N. Y	*Farmington:* Winchell Smith Guaranty
22080	Conkey's Starting Feed. C. E. Conkey Co. Cleveland, Ohio	*New Canaan:* C. H. Fairty Co Guaranty
22086	Laying Mash. C. A. Cowles, Plantsville, Conn	*Plantsville:* C. A. Cowles Guaranty
22065	Wirthmore Buttermilk Mash Feed. Chas. M. Cox Co., Boston, Mass	*New Milford:* Geo. T. Soule Guaranty
22189	Poultry Mash. Crittenden-Benham Co., New Haven, Conn	*New Haven:* Crittenden-Benham Co. Guaranty
22156	Elmore Egg Mash. Elmore Milling Co., Oneonta, N. Y	*Somers:* W. C. Everett Guaranty
22025	Eshelman's Laying Mash. John W. Eshelman & Sons, Lancaster, Pa	*South Norwalk:* Roodner Feed Co Guaranty
22151	Golden Egg Laying Mash. Flory Milling Co., Bangor, Pa	*Bloomfield:* Bloomfield Farmers' Ex. Guaranty
22150	Flory's Superior Egg Mash. Flory Milling Co., Bangor, Pa	*Bloomfield:* Bloomfield Farmers' Ex. Guaranty
22113	Grandin's Poultry Dry Mash with Buttermilk. D. H. Grandin Mill. Co., Jamestown, N. Y.	*Willimantic:* Willimantic Grain Co. Guaranty
22020	Algrane Laying Mash. H-O Cereal Co., Inc., Buffalo, N. Y	*South Norwalk:* Roodner Feed Co Guaranty
22057	Storrs Egg Mash. E. Manchester & Sons, Winsted, Conn	*Winsted:* E. Manchester & Sons Guaranty
22035	Bull Laying Mash. Maritime Milling Co., Buffalo, N. Y	*Stamford:* W. L. Crabb Guaranty
22105	Red Wing Dry Mash. Meech & Stoddard, Inc., Middletown, Conn	*Meriden:* Meriden Grain & Coal Co. Guaranty

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22087	8.06	5.76	23.75	7.57	49.30	5.56	$55.00
.....	....	....	24.00	10.00	.....	5.00	.....
22173	7.72	3.72	9.94	8.73	63.27	6.62	45.00
.....	....	....	9.00	12.00	.....	4.00	.....
22063	8.36	6.60	20.00	3.26	57.13	4.65	68.00
.....	....	....	20.00	.....	.....	3.00	.....
22034	8.86	4.65	15.81	6.06	58.97	5.65	55.00
.....	....	....	15.00	.....	.....	4.00	.....
22036	9.32	7.15	22.13	4.44	51.76	5.20	65.00
.....	....	....	20.00	5.00	.....	5.00	.....
22180	8.64	5.78	18.94	6.23	55.52	4.89	67.00
.....	....	....	18.00	.....	.....	4.00	.....
22142	8.17	6.27	19.44	5.47	55.15	5.50	69.00
.....	....	....	18.00	8.00	.....	4.00	.....
22169	7.33	9.35	20.94	6.89	49.10	6.39	61.00
.....	....	....	18.00	.....	.....	2.00	.....
22143	8.13	6.03	18.44	6.69	55.55	5.16	59.00
.....	....	....	18.00	10.00	.....	4.00	.....
22080	9.42	4.26	12.00	2.52	67.07	4.73	74.00
.....	....	....	12.00	.....	.....	3.00	.....
22086	9.13	7.79	20.13	4.47	52.27	6.21	59.00
.....	....	....	20.00	4.50	.....	4.00	.....
22065	8.24	9.13	21.38	5.17	51.02	5.06	65.00
.....	....	....	20.00	.....	.....	4.00	.....
22189	7.38	10.64	21.88	6.05	47.35	6.70	56.00
.....	....	....	18.00	.....	.....	4.00	.....
22156	7.59	6.93	21.75	5.44	53.01	5.28	62.00
.....	....	....	18.00	.....	.....	4.00	.....
22025	6.48	8.68	23.75	4.78	49.59	6.72	61.00
.....	....	....	20.00	.....	.....	5.00	.....
22151	6.79	7.26	20.81	10.21	49.00	5.93	55.00
.....	....	....	18.00	10.00	.....	4.00	.....
22150	7.46	8.97	20.50	7.59	49.76	5.72	62.00
.....	....	....	20.00	8.00	.....	5.50	.....
22113	8.78	9.25	21.38	5.20	50.48	4.91	59.00
.....	....	....	20.00	.....	.....	3.00	.....
22020	6.79	9.57	17.13	3.71	57.19	5.61	64.00
.....	....	....	17.00	6.00	.....	4.50	.....
22057	7.36	10.01	21.88	5.83	47.64	7.28	56.00
.....	....	....	18.00	.....	.....	4.00	.....
22035	9.70	8.43	21.38	5.21	49.86	5.42	65.00
.....	....	....	20.00	.....	.....	5.00	.....
22105	8.24	8.03	17.00	5.40	55.15	6.18	63.00
.....	....	....	17.00	.....	.....	5.50	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Concluded.*	
	Poultry Feed—Concluded.	
22106	Red Wing Growing Feed. Meech & Stoddard, Inc., Middletown, Conn	*Meriden:* Meriden Grain & Coal Co..
		Guaranty
22152	Marathorn Laying Mash. Nowak Milling Co., Hammond, Ind	*Bloomfield:* Bloomfield Farmers' Ex..
		Guaranty
22090	Lay or Bust Dry Mash. Park & Pollard, Boston, Mass	*Plantsville:* C. A. Cowles
		Guaranty
21992	Platco Laying Mash Mixture. Frank S. Platt Co., New Haven, Conn	*New Haven:* Frank S. Platt Co
		Guaranty
22071	Purina Chicken Chowder. Purina Mills, St. Louis, Mo	*Danbury:* H. E. Meeker
		Guaranty
22178	Ful-O-Pep Dry Mash. Quaker Oats Co., Chicago, Ill	*Putnam:* F. M. Cole
		Guaranty
22140	Quisenberry "Big 4" Laying Mash. Quisenberry Feed Mfg. Co., Buffalo, N. Y..	*Farmington:* Winchell Smith
		Guaranty
22141	Quisenberry Quality Buttermilk Laying Mash. Quisenberry Feed Mfg. Co., Buffalo, N. Y.	*Farmington:* Winchell Smith
		Guaranty
22029	Vitality Egg Mash. Rosenbaum Bros., Chicago, Ill	*Stamford:* Francis H. Leggett & Co...
		Guaranty
22184	Chic-Chuk Poultry Food. Russia Cement Co., Gloucester, Mass	*Hartford:* Meech Grain Co
		Guaranty
22006	Home Made Milk Mash. Seymour Grain & Coal Co., Seymour, Conn	*Seymour:* Seymour Grain & Coal Co..
		Guaranty
22139	Mill Streams Lightnin Laying Mash. Winchell Smith, Farmington, Conn	*Farmington:* Winchell Smith
		Guaranty
22081	Egatine. Tioga Mill & Elevator Co., Waverly, N. Y	*New Canaan:* C. H. Fairty Co
		Guaranty

INSPECTION OF 1923—*Concluded.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22106	7.87	14.86	17.88	4.61	48.79	5.99	$63.00
	....	....	10.00	.....	.....	6.00	.....
22152	7.78	6.82	20.75	5.92	53.61	5.12	56.00
	....	....	20.00	.....	.....	4.50	.....
22090	8.50	9.14	19.38	6.16	51.71	5.11	60.00
	....	....	18.00	.....	.....	1.50	.....
21992	9.93	8.80	18.88	5.70	49.74	6.95	67.00
	....	....	18.94	.....	.....	5.38	.....
22071	8.38	6.89	19.75	7.25	52.56	5.17	75.00
	....	....	19.00	.....	.....	4.00	.....
22178	7.56	9.46	20.88	6.88	49.49	5.73	76.00
	....	....	20.00	.....	.....	4.00	.....
22140	8.01	6.27	17.88	7.65	55.10	5.09	67.00
	....	....	17.00	6.00	.....	4.00	.....
22141	7.85	6.84	20.63	5.28	54.11	5.29	71.00
	....	....	18.00	5.00	.....	4.00	.....
22029	9.09	7.56	21.13	4.68	52.29	5.25	82.00
	....	....	20.00	7.00	....	4.00	.....
22184	3.21	30.15	63.31	.....	1.06	2.27	90.00
	....	....	45.00	.....	.....	2.00	.....
22006	9.89	8.28	18.75	5.22	53.22	4.64	69.00
	....	....	.....	.....	.....	....	.....
22139	8.22	8.99	20.88	5.51	51.10	5.30	61.00
	....	....	16.00	.....	.....	3.00	.....
22081	8.58	8.36	26.63	3.35	47.18	5.90	64.00
	....	....	23.00	.....	.....	2.50	.....

TABLE IV. ANALYSES OF FEEDING STUFFS

Station No.	Material	Submitted by
	OIL SEED PRODUCTS.	
	Cottonseed Meal:	
22206	.....	*Canterbury:* Park B. Smith.....
20802	Danish.....	*Middletown:* The Coles Company....
21780	Cameron-Daniell Co.....	The Coles Company.....
21745	Thirty-six.....	The Coles Company.....
	CORN PRODUCTS.	
22342	Hominy.....	*Bloomfield:* Bloomfield Farmers' Ex..
	PROPRIETARY MIXED FEEDS.	
	Horse, Dairy and Stock Feeds.	
22405	Eastern States Dairy Ration.....	*Hartford:* Francis P. Nolan.....
22406	Cornell Ration.....	Francis P. Nolan.....
19711	Dairy Feed.....	*Meriden:* Raymond Ives.....
22446	Dairy Ration 24%.....	*Middletown:* The Coles Company....
22679	Dairy Ration 24%.....	The Coles Company.....
22560	Dairy Ration 24%.....	The Coles Company.....
20894	Uncle John 24% Cream Pot Ration.....	The Coles Company.....
21259	Uncle John 24% Cream Pot Ration.....	The Coles Company.....
21797	Uncle John 24% Cream Pot Ration.....	The Coles Company.....
21260	Uncle John 18% Dairy Ration.....	The Coles Company.....
21796	Uncle John 18% Dairy Ration.....	The Coles Company.....
21825	Uncle John 18% Dairy Ration.....	The Coles Company.....
21982	Special Dairy Feed.....	The Coles Company.....
22594	Eastern States Milkmore Dairy Ration...	*Rockville:* H. B. Pomeroy.....
21106	Algrane Milk Feed.....	*South Norwalk:* Roodner Feed Co....
20826	Feed No. 1.....	*Yantic:* John H. Ryan.....
20827	Feed No. 2.....	John H. Ryan.....
	Poultry Feeds.	
22626	Eastern States-Egg Mash, No. 1.....	*Central Village:* Birchwood Farm Co.
22627	Eastern States Egg Mash, No. 2.....	Birchwood Farm, Inc.....
21879	Chicken Feed.....	*Centerville:* S. Thomson.....
21859	Fortune Egg Mash.....	*Middletown:* The Coles Company....
22593	Eastern States Egg Mash.....	*Norwich:* F. W. Browning.....
21315	Feed.....	The Yantic Grain & Products Co..
22538	Eastern States Egg Mash.....	The Yantic Grain & Products Co..
20750	Ground Navy Soup Beans.....	*Pittsburgh, Pa.:* Dwight Hamlin, Inc.
	MISCELLANEOUS.	
21841	Wheat Bran.....	*New Haven:* Station Agent, stock of R. G. Davis.....
21842	Cottonseed Meal.....	Station Agent.....
21843	Corn Meal.....	Station Agent.....
21844	Dairy Ration.....	Station Agent.....

SUBMITTED BY INDIVIDUALS.

Station No.	Pounds per Hundred						Remarks
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22206	....	....	36.13	....	....	....	
20802	....	....	37.44	....	....	....	
21780	....	....	35.69	....	....	....	
21745	....	....	34.75	....	....	....	
22342	9.54	2.34	10.00	3.78	68.08	6.26	
22405	5.84	5.12	22.63	6.38	54.70	5.33	
22406	5.31	9.28	19.69	6.31	53.60	5.81	
19711	12.57	5.85	19.69	6.17	51.41	4.31	
22446	8.11	5.27	22.75	6.44	51.75	5.68	
22679	5.53	....	23.50	....	....	6.59	Guaranty; protein 24 per cent.
22560	....	....	23.31	....	....	....	
20894	....	....	24.81	....	....	....	Guaranty; protein 24 per cent.
21259	....	....	24.00	....	....	....	Guaranty; protein 24.90 per cent.
21797	....	....	24.56	....	....	....	Guaranty; protein 24 per cent.
21260	....	....	17.50	....	....	....	Guaranty; protein 18.90 per cent.
21796	....	....	16.75	....	....	....	Guaranty; protein 18 per cent.
21825	....	....	16.75	....	....	....	Guaranty; protein 18 per cent.
21982	9.22	5.84	20.88	7.50	50.02	6.54	
22594	....	....	25.00	....	....	....	Guaranty; protein 24 per cent.
21106	....	....	17.50	....	....	....	Guaranty; protein 16 per cent.
20826	....	....	11.88	....	....	....	
20827	....	....	6.13	....	....	....	
22626	....	....	23.63	....	....	....	Guaranty; protein 20 per cent.
22627	....	....	25.38	....	....	....	Guaranty; protein 20 per cent.
21879	10.59	7.76	21.50	4.43	50.72	5.00	
21859	9.03	11.02	18.25	5.46	51.20	5.04	
22593	....	....	23.50	....	....	....	Guaranty; protein 22 per cent.
21315	....	....	22.63	....	....	....	
22538	10.20	5.10	22.75	5.79	51.75	4.41	
20750	7.19	5.73	24.00	4.89	56.53	1.66	
21841	11.46	5.57	15.38	9.96	51.58	6.05	Feeding Experiments, Storrs.
21842	8.91	5.27	34.50	15.37	29.77	6.18	Feeding Experiments, Storrs.
21843	13.36	1.07	9.75	2.60	70.21	3.08	Feeding Experiments, Storrs.
21844	11.51	3.75	17.81	8.52	53.53	4.88	Feeding-Experiments, Storrs.

TABLE IV. ANALYSES OF FEEDING STUFFS,

Station No.	Material	Submitted by
	MISCELLANEOUS—*Concluded.*	
21835	Eastern States Milkmore Ration	*Meriden:* Station Agent, stock of Minor Ives
21836	Eastern States Egg Mash	Station Agent, stock of Minor Ives
22234	Eastern States Milkmore Ration	*Farmington:* Station Agent, stock of C. E. Stephenson
22235	Eastern States Milkmore Ration	Station Agent, stock of C. E. Stephenson
22236	Eastern States Milkmore Ration	Station Agent, stock of C. E. Stephenson
20514	Mill Sweepings	Wadsworth & Wadsworth
22612	Spratt's Dog Biscuit	*Hartford:* Dairy & Food Comm'r.
22613	Austin's Dog Biscuit	Dairy & Food Commissioner

MISCELLANEOUS SAMPLES.

SAMPLES SUBMITTED BY INDIVIDUALS OR DRAWN AT THEIR REQUEST.

Table IV summarizes analyses made for individuals. In most cases samples were drawn by the senders; but in a few cases samples were officially drawn by our agent on request.

These samples come under the head of gratuitous analyses which have been discussed elsewhere in this report.

MATERIALS EXAMINED FOR POISONS.[1]

19794. *Stock Feed.* Submitted by a purchaser. With the aid of a lense green particles were plainly seen in this sample. Qualitative tests showed copper and arsenic (the essential constituents of Paris Green), in considerable amounts.

21570. *Poultry Mash.* Submitted by a dealer. Thirty chickens died after eating this mash. The feed was composed chiefly of corn meal, bran, oats, etc. Green particles were seen in the feed and there were lumps in which the green substance was present. Chemical tests showed the presence of considerable quantities of copper and arsenic. Paris Green had become mixed with the feed accidentally or otherwise.

18658, 20858, 21915, 22219, 22287, and **22288.** These feeds were examined but nothing was found to explain the unfavorable or fatal results reported to have followed the feeding of these products.

CONDIMENTAL FOODS.[1]

22361. *Stock Conditioner.* Guarantee Feed Co. of Pennsylvania, Lewisburg, Pa. The company guarantees to indemnify the user of this product against loss of his stock by contagious disease provided he has fed the conditioner continuously and in accord with directions.

[1] Examined by C. E. Shepard.

SUBMITTED BY INDIVIDUALS—*Concluded.*

Station No.	Pounds per Hundred						Remarks
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
21835	9.51	6.42	24.81	8.78	45.53	4.95	Guaranty; protein 24.00, fat 5.00, fiber 9.00 per cent.
21836	10.84	4.75	23.88	5.44	50.25	4.84	Guaranty, protein 22.00, fat 3.5, fiber 7.00 per cent.
22234	10.53	4.65	25.50	7.10	47.26	4.96	Guaranty; protein 24.00, fat 5.00 per cent.
22235	9.04	6.93	25.19	8.75	45.36	4.73	Guaranty; protein 24.00 per cent.
22236	8.02	7.06	26.75	8.57	44.17	5.43	Guaranty; protein 24.00; fat 5.00 per cent.
20514	6.41	6.85	28.63	15.81	36.58	5.72	
22612	6.20	3.59	19.88	0.49	66.18	3.66	
22613	7.52	1.99	13.00	0.30	75.02	2.17	

Examination of a sample of this product submitted by a prospective agent was made with the following results:

Moisture 9.88 per cent.; nitrogen 1.12 per cent.; ash (mineral matter), 9.58 per cent.; vegetable bitters, none detected; emodin-like substances, none found; saltpeter, none found; fenugreek bicarbonate of soda, ferrous sulphate and magnesium sulphate, present; seed coats or hulls, large amount present.

Seed coats (resembling cotton hulls) comprised a large proportion of the product. There was about 10 per cent. of mineral matter consisting chiefly of, or containing, bicarbonate of soda, iron and epsom salt. No vegetable bitters or vegetable cathartics were detected.

The mineral ingredients found in this preparation are not uncommon in so-called stock conditioners and tonics. We have no information as to what the directions for feeding this remedy (as specified in the guaranty), are. However, the observation of a leading authority[1] on feeds and feeding seems pertinent in this connection. This text says: "The stock foods are usually accompanied by directions which advocate liberal feeding and good care for the animals to be fed in order to secure the benefits from the tonic". In other words some benefit is bound to arise from the increased care and attention which the animals will be given.

[1] Henry and Morrison.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Report on Commercial Insecticides and Fungicides

I. TEXT OF THE INSECTICIDE LAW OF CONNECTICUT AND REGULATIONS FOR ITS ENFORCEMENT.

II. EXAMINATION OF INSECTICIDES, FUNGICIDES, ETC.

CONTENTS.

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

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June, 1924.

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Tobacco Sub-station at Windsor.
N. T. Nelson, Ph.D., *Plant Physiologist.*

The Wilson H. Lee Co.

Rules and Regulations for Carrying Out the Provisions of the Insecticide and Fungicide Law.

By authority of Section 5 of the Insecticide and Fungicide Act, Chapter 258, Public Acts of 1923, the following rules and regulations have been adopted for carrying out the provisions of the act.

As further provided in said Section these rules and regulations conform, so far as possible, to those laid down by the Secretary of Agriculture of the United States for the enforcement of the Federal Insecticide Act.

Sections cited under each regulation refer to the section of the State law wherein the term defined, or the clause interpreted, occurs; and the citation following each regulation refers to the Federal regulation which corresponds thereto.

Wm. L. Slate, Jr.
Director of the Conn. Agricultural Experiment Station.

Thomas Holt.
Dairy and Food Commissioner.

Regulation 1. Original Unbroken Package.

(Section 5.)

The term "original unbroken package" as used in Section 5 of the act, and in these regulations, is the original package, carton, case, can, box, barrel, bottle or other container put up by the manufacturer or dealer, to which the label is attached or which may be suitable for the attachment of a label, making one complete package of the article of insecticide or fungicide. The original package contemplated includes both the wholesale and the retail package.

Regulation 2. Definitions of Insect and Fungi.

(Section 2.)

Insect. The term "insect" as used in Section 2, or elsewhere in the act, and in these regulations, is held to mean any of the numerous small invertebrate animals generally having the body more or less obviously segmented, for the most part belonging to the class *Insecta*, comprising six-legged, usually winged forms, as beetles, bugs, bees, flies, etc., and to other allied classes of arthropods whose members are wingless and usually have more

than six legs, as spiders, mites, ticks, centipedes, wood lice, etc. (F. R. 14.)

Fungi. The term "fungi", as used in Section 2, or elsewhere in the act, and in these regulations, is held to mean all nonchlorophyll-bearing plants of a lower order than mosses and liverworts (i.e. nonchlorophyll-bearing thallophytes), comprising rusts, smuts, mildews, molds, yeasts, bacteria, etc. (F.R. 14a.)

Regulation 3. Concerning Labels.

(Section 4.)

(a) The term "label" as used in Section 4, or elsewhere in the act, and in these regulations, is held to include any legend, descriptive matter or design printed, stenciled, stamped, seared or impressed upon the article or its container and also to include circulars, pamphlets, etc., which are packed and go with the article to the purchaser. (F.R.10.)

(b) Whenever, by the terms of the act, information is required to be stated upon the label of an insecticide or fungicide, such as the statement of percentage of arsenic contained therein, a label must be placed on the article in order that the statement can be made and the omission of a label does not excuse the absence of the required statement. (F.R.11.)

(c) All information required to be given on the label must be plainly and correctly stated in type sufficiently clear and in position sufficiently prominent to attract the immediate attention of the purchaser. (F.R.12.)

(d) Descriptive matter upon the label must be free from any statement, design or device regarding the article or the ingredients or substances contained therein, or regarding the quality or effects thereof, which is false or misleading in any particular. (F.R.15.)

(e) The use of any false or misleading statement, design or device appearing upon the label shall not be justified by any statement given as the opinion of an expert or other person, nor by any descriptive matter explaining the use of the false or misleading statement, design or device. (F.R.17.)

Regulation 4. Concerning the Name and Address of the Manufacturer.

(Section 5.)

The name of the manufacturer or producer or the place of manufacture is not required to be given upon the label, but if given it must be the true name and true place. If the name appearing upon the label is not that of the actual manufacturer or producer it shall be preceded by the words "Packed for. . . .," "Distributed by. . . . . ," or some equivalent phrase. In case

no name appears the dealer is held responsible unless he can furnish a guaranty from the wholesaler, jobber or manufacturer as provided in Section 5 of the act.

Regulation 5. Concerning the Collection of Samples.

(Section 7.)

Section 7 of the act provides that duly authorized agents of the Connecticut Agricultural Experiment Station or of the Dairy and Food Commissioner may take duplicate samples of any insecticide or fungicide upon tendering the market price thereof.

Such samples shall be representative of the lot or parcel sampled. In the case of bulk goods the sample shall be divided in two parts each sealed, dated and marked for identification. In case of goods in package form if each package be 2 pounds or less in weight or 1 quart or less in volume, two packages may be taken each sealed, dated and marked for identification. If packages are more than 2 pounds in weight or more than 1 quart in volume, a sample may be taken in whatever way is most practicable, divided into two parts, each sealed, dated and marked for identification. In all cases one of the duplicate samples shall be delivered by the sampling agent to the Connecticut Agricultural Experiment Station for analysis and the other left with the person whose stock is sampled.

Regulation 6. Concerning Methods of Analysis.

(Section 7.)

The methods of analysis employed shall be those prescribed by the Association of Official Agricultural Chemists or other approved methods.

An Act Concerning the Manufacture, Sale and Transportation of Adulterated or Misbranded Insecticides and Fungicides.

(Chapter 258, Public Acts of 1923.)

Section 1. No person shall manufacture, sell, offer or expose for sale any Paris green, lead arsenate or other insecticide or any fungicide which is adulterated or misbranded within the meaning of this act.

Sec. 2. The Term "insecticide" shall include any substance or mixture of substances intended to destroy or repel insects. The term "Paris green" shall include the product commercially known as Paris green and chemically known as aceto-arsenite of copper. The term "lead arsenate" shall include the products commercially known as lead arsenate consisting chemically of products derived from arsenic acid (H_3AsO_4) by replacing one or more hydrogen atoms by lead. The term "fungicide" shall include any substance or mixture of substances intended to lessen the growth of or destroy fungi.

Sec. 3. Paris green shall be deemed adulterated: (a) when it shall not contain at least fifty per centum of arsenious oxide (As_2O_3); (b) when it shall contain arsenic in water-soluble forms equivalent to more than

three and one-half per centum arsenious oxide (As_2O_3); or (c) when any substance shall have been mixed and packed with it so as to reduce, lower or injuriously affect its quality or strength. Lead arsenate, not dry or powdered, shall be deemed adulterated: (a) When it shall contain more than fifty per centum of water; (b) when it shall contain total arsenic equivalent to less than twelve and one-half per centum arsenic oxide (As_2O_5); (c) when it shall contain arsenic in water-soluble forms equivalent to more than seventy-five one-hundredths per centum arsenic oxide (As_2O_5); or (d) when any substance shall have been mixed and packed with it so as to reduce, lower or injuriously affect its quality or strength; provided lead arsenate and water shall not be deemed to be adulterated when such mixture shall contain more than fifty per centum of water if such mixture shall be labeled lead arsenate and water and the percentage of water shall be plainly and correctly stated on the label. Dry or powdered lead arsenate shall be deemed adulterated when it shall contain total arsenic equivalent to less than twenty-five per centum of arsenic oxide (As_2O_5) and arsenic in water-soluable forms equivalent to more than one and one-half per centum of arsenic oxide (As_2O_5). Insecticides and fungicides other than Paris green and lead arsenate shall be deemed adulterated: (a) When the strength or purity shall fall below the standard or quality under which it shall be sold; (b) when any substance shall have been substituted wholly or in part for the article described; (c) when any valuable constituent of the article shall have been wholly or in part abstracted; or (d) when it shall be intended for use on vegetation and shall contain any substance which, although destroying or repelling insects or lessening the growth of or destroying fungi, shall be injurious to vegetation upon which it may be used.

Sec. 4. The term "misbranded," as used in this act, shall apply to any insecticide or fungicide, or any article which shall enter into the composition of any insecticide or fungicide, the package or label of which shall bear any statement, design or device regarding such article or any ingredient or substance contained therein which shall be false or misleading in any particular, including any statement, design or device which shall be false or misleading as to the place of manufacture thereof. Any insecticide, other than Paris green or lead arsenate, and any fungicide shall be deemed misbranded: (a) When it shall contain arsenic in any of its combinations or in the elemental form and the amount of arsenic present shall not be stated on the label as the per centum of metallic arsenic; (b) when it shall contain arsenic in any of its combinations or in the elemental form and the amount of arsenic in water-soluble forms shall not be stated on the label as the per centum of metallic arsenic; (c) when it shall consist partially or completely of any inert ingredient which shall not destroy or repel insects or lessen the growth of or destroy fungi and shall not have the name and percentage amount of each of such inert ingredients plainly and correctly stated on the label; provided, in lieu of naming and stating the percentage amount of each inert ingredient, the producer may, at his discretion, state plainly on the label the correct name and percentage amount of each ingredient of the insecticide or fungicide having insecticidal or fungicidal properties and, make no mention of the inert ingredients except to state the total percentage thereof.

Sec. 5. The dairy and food commissioner and the director of the Connecticut Agricultural Experiment Station, acting jointly, shall make all necessary rules and regulations for carrying out the provisions of this act, such rules and regulations to conform, where possible, to the rules and regulations of the government of the United States authorized by the federal insecticide act of 1910. Upon complaint or information of a violation of any provision of this act, submitted by the Connecticut Agricultural Experiment Station, said commissioner and said director shall hold a hearing thereon, giving reasonable notice and opportunity

to any person accused of any violation hereof to be present and be heard. If said commissioner and said director shall be of the opinion that any person shall have committed a violation of any provision of this act, they shall place all evidence thereof which they shall have secured with any prosecuting authority having jurisdiction; but no person shall be penalized under the provisions of this act for selling or offering for sale any article of insecticide or fungicide in the original unbroken package in which it was received by him, provided he shall establish a guaranty by the wholesaler, jobber, manufacturer or other person residing in the United States, from whom any such article shall have been purchased, that such article is not adulterated or misbranded within the meaning of this act, which guaranty shall contain the name and address of the guarantor, but such guarantor shall be amenable to prosecution and penalties.

Sec. 6. Any person manufacturing, selling, offering or exposing for sale any insecticide or fungicide in violation of any provision of this act shall be fined not more than two hundred dollars for the first offense and not more than three hundred dollars for each subsequent offense.

Sec. 7. The Connecticut Agricultural Experiment Station or the dairy and food commissioner, or both, or their deputies, may, upon tendering the market price thereof, take duplicate samples from any lot, parcel or package of insecticide or fungicide which may be in the possession of any person. Each such sample shall be taken in the presence of the owner or his representative, and shall be sealed and properly marked for identification. One of such samples shall be left with the person from whom taken and the other shall be retained by the official taking the same, The Connecticut Agricultural Experiment Station shall annually analyze at least one sample of each brand of insecticide or fungicide so collected and such analysis shall include determinations of the active ingredients which the article contains, with such other determinations as may be deemed advisable. Results of such analyses shall be published in the bulletins of said Connecticut Agricultural Experiment Station, with such information regarding the character, composition and use thereof as may be of interest or importance. Such bulletins shall be issued annually or at such other intervals as may be deemed advisable.

Part II. Examination of Insecticides, Fungicides, Etc.

E. M. Bailey*

INTRODUCTION

The Legislature of 1923 passed an act concerning the manufacture, sale and transportation of adulterated insecticides and fungicides. The text of the law and regulations, made as provided therein for its enforcement, are given in Part I of this report. Both the law and such regulations as have been made are substantially the same as the federal law and regulations so that articles of this class which satisfy the requirements of interstate commerce will be accepted in this State.

The law requires this Station to make analyses of samples which may be collected by the Dairy Commissioner or by our Station agent. Evidence of adulteration or misbranding is required to be reported to the Dairy Commissioner who is responsible for enforcement of the law. Analyses and such other information regarding the character, composition and use of these materials as may be of interest are required to be published in bulletins of this station, either annually or at other intervals as may be advisable. The law carries no specific appropriation for the inspection work and a complete survey of the entire field of insecticides and fungicides each year is not thought to be advisable or necessary.

An inspection was made in 1922 the results of which have been published.[1] Since then no general official inspection has been made but a few samples have been collected by our Station agent and others have been submitted by the departments of Entomology and of Botany of this Station and by others interested. Part II of this report gives the results of the examination of these samples.

The report includes a special analytical study of healthy and of diseased plants, chiefly tobacco. This work was done in collaboration with the Department of Botany in connection with their studies in vegetable pathology. Though not immediately connected with the purpose of this bulletin the results are recorded here as of interest.

CLASSIFICATION OF MATERIALS.

The samples analyzed may be classified as follows:

*With the collaboration of Messrs. Andrew, Fisher, Nolan and Shepard.

1. Conn. Exp. Sta., Bull. 242, 1922.

Material	No. of samples.
Lead arsenate	3
Casein spreaders	5
Copper dusts, etc	4
Sulphur preparations	6
Nicotine preparations and tobacco	18
Tobacco, etc. healthy and diseased	12
Lime, for spraying	4
Miscellaneous	15
Total	67

METHODS OF ANALYSIS.

The methods of analysis employed are those authorized by the Association of Official Agricultural Chemists unless otherwise stated.

RESULTS OF INSPECTION AND ANALYSIS.

Arsenate of Lead.

21588. A sample of dry arsenate of lead was submitted by the department of Botany in connection with an investigation of foliage injury after spraying. The sample was of normal composition and the amount of water-soluble arsenic was not excessive.

Analysis: Total lead oxide (PbO), 63.34 per cent; total arsenic (As_2O_5), 32.16 per cent; water-soluble arsenic (As_2O_5), 0.30 per cent.

Two other samples were examined. One, **21437,** contained an excess of water-soluble arsenic, viz., 1.78 per cent. as As_2O_5, the limit for water-soluble arsenic being 1.50 per cent. The other sample, **23303,** was submitted for identification. It was shown to be lead arsenate containing only 0.50 per cent. of water-soluble arsenic as As_2O_5.

Casein Spreaders, "Calcium Caseinate."

Five samples representing three different brands have been examined.

Table I. Analyses of "Calcium Caseinate".

No.	Brand and Manufacturer	Nitrogen %	Casein (N x 6.38)	Lime (CaO)
22487	*A-?-ML* Casein Mfg. Co., New York	7.92	50.53	27.27
22601	*Kayso* California Central Creameries, San Francisco, Cal	3.26	20.80	48.25
22602	*Red Diamond* Rosin & Co., Philadelphia, Pa	2.98	19.01	55.26
22731	*Red Diamond* Rosin & Co., Philadelphia, Pa	3.36	21.44	52.56
22614	*Red Diamond* Rosin & Co., Philadelphia, Pa	3.59	22.90	44.11

These materials are mechanical mixtures of casein and lime in varying proportions and are not caseinates in the chemical sense of that term. They are used to facilitate the distribution of spray materials uniformly over the surface of foliage.

Four of the samples examined contain casein and lime in roughly the same proportions; the other sample shows a much greater proportion of casein.

Copper Dusts, Etc.

21416. *Niagara, D 25 Potato Dust.* Made by the Niagara Sprayer Co., Middleport, N. Y. This was guaranteed to contain 8.6 per cent. of copper (metallic), equivalent to 24.0 per cent. monohydrated copper sulphate; inert 76 per cent. Copper found was 8.9 per cent.

21414. *Dosch B-12 Green Copper Arsenic Dust.* Made by the Dosch Chemical Co., Louisville, Ky. The active ingredients guaranteed are copper (as metallic), not less than 5.75 per cent. and arsenic (as metallic), not less than 2.75 per cent. Copper found was 5.79 per cent. and arsenic 3.39 per cent. Arsenic is present as calcium arsenate.

20903. *Sanders' Dust.* Sample was submitted by a purchaser. It contained 6.10 per cent. of copper (as metallic), and 2.93 per cent. of arsenic (as metallic). Arsenic was found to be combined with calcium.

21264. *Bordeaux powder.* Sample sent by County Agent J. H. Fay. It was found to contain 14.34 per cent. of copper (as metallic).

Sulphur Preparations.

21415. *Niagara 90-10 Dusting Mixture (Pomodust).* Made by the Niagara Sprayer Co., Middleport, N. Y. The active ingredients declared were sulphur not less than 88 per cent., lead arsenate not less than 9.80 per cent., total arsenic (as metallic), not less than 1.95 per cent, and water-soluble arsenic (as metallic), not over 0.5 per cent.

Partial analysis showed 87.79 per cent. of sulphur, 1.84 per cent. of total arsenic (as metallic), and 0.24 per cent. of water-soluble arsenic (as metallic), which conforms substantially with the guaranty.

21413. *Niagara Soluble Sulphur Compound.* Made by the Niagara Sprayer Co., Middleport, N. Y. The sample examined was not an original package and the analysis does not fairly represent the composition of the fresh material. Polysulphides readily oxidize on exposure to air and pass into less active combinations. The composition of the original material was declared to be: sodium polysulphide 40 per cent., sodium thiosulphate, 18 per cent., free sulphur 3 per cent. and inert ingredients, 39 per cent. The amount of total sulphur found (41.4 per cent.), agreed closely

with that calculated from the ingredients declared, assuming polysulphide to be as pentasulphide, but its distribution was largely as thiosulphate and free sulphur. Directions properly caution against undue exposure of the material before using.

21417. *Niagara Dusting Sulphur. Sulfodust.* Made by the Niagara Sprayer Co., Middleport, N. Y. The material contained 92.4 per cent. of sulphur which conformed substantially to the guaranty of 93 per cent. with inert ingredients, 7 per cent.

22645. *Solbar.* Made by Bayer Company, New York. This is a "brand of barium sulphide compound for plant protection (polysulphide of barium)."

Analysis: Soluble in cold water 59.58 per cent; sulphide sulphur 15.04 per cent; thiosulphate sulphur 2.55 per cent; total soluble sulphur 17.59 per cent; total soluble barium (BaO), 43.42 per cent; insoluble sulphur 6.13 per cent; insoluble barium 9.35 per cent.

The soluble portion consists chiefly of barium sulphide or polysulphide and barium thiosulphate.

22697. *Colloidal Sulphur.* This was a sulphur paste, manufacturer unknown, containing 36.3 per cent. of sulphur.

22532. *Lime-sulphur solution.* This sample submitted by a purchaser was of average composition. It had a specific gravity at 15.6° C of 32 (Baumé), and contained 25.53 per cent. of sulphur.

Nicotine Products.

21258. *Niagara New Nicotine Contact Mixture D-1.* Made by the Niagara Sprayer Co., Middleport, N. Y. This dusting mixture is guaranteed to contain 1.25 per cent. of nicotine and 98.75 per cent. of inert ingredients. It contained 1.43 per cent. of nicotine (as alkaloid).

21129 and **21130.** *Nicotine dusts.* Samples were submitted by a purchaser. No. **21129** was a white powder containing 1.51 per cent. of nicotine (alkaloid); 96 per cent. of the material passed a 200 mesh sieve. No. **21130** was a brown powder which contained 0.72 per cent. of nicotine (alkaloid); 77.5 per cent. passed a 200 mesh sieve.

21831. *Axfixo.* Heightstown Hardware Co., Heightstown, N. J. Declared to contain not less than 1.25 per cent. nicotine; inert 98.75 per cent.

Analysis: Total ash 96.50 per cent; insoluble ash 1.28 per cent; lime (CaO), 31.85 per cent; magnesia (MgO), 23.57 per cent; nicotine 1.47 per cent.

On exposure to air in open container at room temperature the following amounts of nicotine were found at the intervals stated: After 24 hours 1.07 per cent.; 5 days, 0.35 per cent.; 10 days 0.18 per cent.; 15 days 0.12 per cent.

Tobacco.

Four samples of tobacco grown at the Tobacco Station at Windsor were examined as follows:

Table II. Analyses of Tobacco.

(Air-dry material)

No.	Material	Moisture	Nitrogen	Nicotine	Potash (K_2O)	Phosphoric acid (P_2O_5)
		%	%	%	%	%
19917	Broadleaf suckers..	4.06	3.85	0.68	....	1.00
19918	Leaves, shade grown	5.09	3.85	0.78	5.37	0.86
19920	Stalks, shade grown	5.09	1.72	0.26	3.69	0.45
19919	Havana.....	3.61	3.02	0.60	4.53	0.90

Six samples of tobacco grown at Storrs were analyzed for ash, nitrogen and nicotine. Results are given in Table III.

Table III. Analyses of Tobacco.

(Moisture-free basis).

No.	Material	Ash	Nitrogen	Nicotine
		%	%	%
22576	Rustica, without tops or suckers....	23.63	3.89	6.57
22577	Rustica, tops and suckers.....	29.16	3.05	2.49
22578	Rustica, with tops, without suckers.	25.52	3.22	4.90
22579	Rustica, without tops or suckers....	16.08	3.78	1.65
22580	Rustica, with tops, without suckers.	13.91	3.38	1.44
22581	Rustica, tops and suckers.....	17.68	4.13	1.38

Four other samples of tobacco were analyzed in connection with the study of a method for determining nicotine. One of these was smoking tobacco (Bull Durham), the analysis of which is as follows:

20175. Moisture 7.23 per cent; ash 14.03 per cent; ash insoluble in acid 1.42 per cent; phosphoric acid in soluble ash 3.68 per cent; nitrogen 2.20 per cent; nicotine 2.60 per cent.

Comparative Analyses of Healthy and of Diseased (Calicoed) Leaves of Tobacco, Tomato and Petunia.

These analyses of normal and of calicoed leaves were made primarily for the benefit of the Department of Botany of this Station in connection with their studies in plant pathology.

The leaves were selected from relatively the same positions on the stalks in order that they might be of as nearly equal age and development as possible. The material was then dried in a current of warm air and the air dry substance used for analysis. Results were calculated (a) to the basis of the fresh green leaf, and (b) to the water-free material.

Generalities cannot, of course, be based upon such a limited number of analyses. The natural variations which may occur in the composition of healthy leaves and of diseased leaves must be

reasonably established before attempting to compare the one type with the other too minutely. However, the analytical data, which is in some detail, is of interest. The nitrogen content of all the diseased plants was found to to be higher than that of the healthy leaves; and it generally holds that the carbohydrates are lower in the diseased leaves. Making allowance for ash insoluble in acid (sand, etc.), the results indicate that the diseased leaves are somewhat poorer in mineral constituents than the healthy leaves but the evidence is not altogether consistent. Differences between the separate ash constituents are either so inconspicuous as to magnitude, or so inconsistent as to value (+ or −), that no exact conclusions seem warranted. Analyses are given in Table IV.

Two other samples of healthy and of diseased leaves of tobacco were analyzed less completely as follows:

	Healthy leaves **19992**	Calicoed leaves **19993**
	%	%
Moisture.....	4.88	4.98
Ash.....	23.33	18.82
Nitrogen.....	3.36	5.34
Nicotine.....	0.96	0.92

Lime for Spraying.

Four samples were submitted by purchasers chiefly to determine whether they contained much magnesia. For spraying purposes calcitic lime is preferred. Three of the samples examined were of the dolomitic type, containing 28 to 32 per cent. of magnesia (MgO).

Miscellaneous Materials.

20808. *Schnarr's Insecticide.* Made by the Van Antwerp Drug Corporation, Mobile, Ala.

Analysis: Moisture 33.68 per cent; ash 1.44 per cent; total fatty acids 8.25 per cent; free fatty acids (as oleic acid), 0.77 per cent; mineral oil 49.13 per cent.

The preparation is a paste consisting of, or containing, mineral oil emulsified with soap. Other active ingredients, if present, not identified.

20715. *Keresol.* Claasen, Murfit and Co., Philadelphia.

Analysis: Ash 1.30 per cent; phenol 4.15 per cent; light oil (kerosene), 80 per cent; residual (largely soap), 12 per cent (approx.).

The partial analysis indicates that the preparation consists essentially of an emulsion of kerosene and soap containing phenol.

20716. *Sun Miscible Oil.* Sun Co., Boston and New York.

Analysis: Ash 2.85 per cent; unsaponifiable 79 per cent; saponified fatty material 16 per cent.

TABLE IV. ANALYSES OF HEALTHY AND DISEASED LEAVES.

	Havana Tobacco				Cuban Tobacco			
	Healthy 21790A		Calicoed 21791A		Healthy 21792A		Calicoed 21793A	
	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free
Moisture	88.91	00.00	88.36	00.00	84.72	00.00	84.21	00.00
Ash	2.32	20.91	2.34	20.06	3.18	20.79	3.38	21.41
Nitrogen	0.43	3.88	0.56	4.84	0.63	4.09	0.74	4.67
Nicotine	0.21	1.88	0.21	1.79	0.34	2.25	*	*
Carbohydrate:								
Starch	....	....	0.24	2.03	0.26	1.71	0.24	1.54
Sol. carbohydrate as dextrose	0.70	6.33	0.72	6.16	1.26	8.23	1.03	6.54
Insoluble in acid	0.11	0.95	0.08	0.68	0.49	3.18	0.72	4.57
Iron and Aluminum ($Fe_2O_3+Al_2O_3$)	0.04	0.32	0.02	0.21	0.09	0.60	0.11	0.67
Manganese (Mn_3O_4)	0.02	0.15	0.01	0.09	0.02	0.10	0.01	0.06
Magnesium (MgO)	0.17	1.49	0.16	1.36	0.20	1.31	0.21	1.30
Calcium (CaO)	0.54	4.90	0.53	4.58	0.70	4.59	0.70	4.42
Potassium (K_2O)	0.72	6.53	0.72	6.23	0.77	5.03	0.71	4.52
Phosphoric acid (P_2O_5)	0.09	0.78	0.10	0.88	0.13	0.84	0.14	0.90
Sulphuric acid (SO_3)	0.20	1.81	0.16	1.35	0.21	1.39	0.19	1.22

* Sample too small, all used for other determinations.

TABLE IV. ANALYSES OF HEALTHY AND DISEASED LEAVES—(*Continued*)

	Broad Leaf Tobacco				Tomato				Petunia			
	Healthy 21794		Calicoed 21795		Healthy 21803		Calicoed 21804		Healthy 21856		Calicoed 21855	
	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free
Moisture	86.61	00.00	86.73	00.00	84.72	00.00	85.23	00.00	80.26	00.00	81.01	00.00
Ash	2.46	18.33	2.58	19.45	3.85	25.20	3.18	21.50	4.38	22.14	4.74	25.07
Nitrogen	0.60	4.49	0.67	5.07	0.54	3.52	0.68	4.61	0.45	2.28	0.55	2.92
Nicotine	0.35	2.63	0.36	2.70	....	....	....	....	....	....	....	....
Carbohydrate:												
Starch	0.26	1.97	0.20	1.51	0.19	1.24	0.15	1.01	0.14	0.73	0.12	0.62
Sol. carbohydrate as dextrose	0.84	6.28	0.66	4.95	0.77	5.05	0.76	5.17	0.99	5.01	0.69	3.65
Insoluble in acid	0.12	0.92	0.28	2.12	0.23	1.53	0.31	2.11	2.46	12.44	2.63	13.91
Iron and Aluminum ($Fe_2O_3+Al_2O_3$)	0.03	0.23	0.05	0.40	0.05	0.34	0.03	0.21	0.39	1.96	0.38	1.99
Manganese (Mn_3O_4)	0.01	0.07	0.01	0.08	0.01	0.09	0.01	0.08	0.01	0.06	0.03	0.14
Magnesium (MgO)	0.16	1.20	0.17	1.29	0.24	1.55	0.21	1.41	0.12	0.61	0.13	0.69
Calcium (CaO)	0.52	3.88	0.57	4.27	1.06	6.95	0.82	5.53	0.26	1.31	0.23	1.24
Potassium (K_2O)	0.79	5.90	0.70	5.27	0.80	5.24	0.77	5.20	0.69	3.51	0.81	4.29
Phosphoric acid (P_2O_5)	0.10	0.76	0.10	0.75	0.09	0.62	0.12	0.82	0.14	0.73	0.16	0.84
Sulphuric acid (SO_3)	0.14	1.06	0.13	0.99	0.52	3.41	0.42	2.83	0.08	0.42	0.08	0.43

This preparation appears to be a mixture of mineral oil and a sodium soap.

22855. *Verm-O-Spray.* Verm-O-Spray Products Co., West Haven, Conn.

Analysis: Sp. Gr. at 15.6° C. 0.8825; ash trace; flash point 61.0°C (142°F); fire point 64°C. (147°F); salicylate present.

This preparation consists of, or contains, chiefly kerosene and methyl salicylate. Other active ingredients, if present, not identified.

20811. *Roach Liquid.* The Pied Piper Service, Providence, R. I.

The sample submitted appeared to be largely kerosene and methyl salicylate. Other active ingredients, if present, were not identified.

20809. *Roach Powder.* The Pied Piper Service, Providence, R. I.

Analysis: Moisture 14.57 per cent; nitrogen 0.5 per cent, equivalent to protein 3.13 per cent; starch 13.73 per cent; ash 40.60 per cent; sodium oxide (Na_2O), 18.89 per cent; boron oxide (B_2O_3), 18.32 per cent; chlorine 5.12 per cent; silica, iron, sulphate, phosphate, traces.

The preparation consists essentially of a cereal, or other starchy material, with borax and salt. Active ingredients other than borax, if present, were not detected.

20112. *Herbicide.* Reade Manufacturing Co., Jersey City, N. J. This is sold as a weed exterminator. It is a green alkaline solution.

Analysis: Solids 31.09 per cent; arsenic (as As_2O_3), 24.30 per cent; sodium arsenite ($NaAsO_2$), calculated from As_2O_3 = 31.9 per cent.

The preparation is essentially a solution of sodium arsenite.

21127. *Be-Health.* General Laboratories, Madison, Wis. This is a special sodium hypochlorite solution prepared for treating foul brood in bees. Active ingredients declared 8.50 per cent; inert 91.50 per cent.

Analysis: Available chlorine 3.77 gms. per 100 cc.; total chlorine 3.81 gms. per 100 cc; sodium hypochlorite (NaOCL), equivalent to available chlorine 3.96 gms. per 100 cc.; sulphates trace; calcium none.

Available chlorine determined 33 days after the first analysis was made showed 3.70 gms. per 100 cc., indicating practically no deterioration in that length of time. During the interval the solution remained corked in the original container at ordinary room temperature. Assuming the active ingredient to be sodium hypochlorite the guaranty is more than twice as high as it should be.

20391 and **20404.** *Qykade.* The Chlorine Products Co., New York. Solution of chlorine.

Analysis: **20391.** Total solids 1.26 gms. per 100 cc.; available chlorine 0.40 gm. per 100 cc; total chlorine 0.71 gm. per 100 cc; lime (CaO), 0.64 gm. per 100 cc. **20404.** Available chlorine 0.37 gm. per 100 cc.

Available chlorine determined in **20391** about 40 days after the first analysis showed available chlorine of 0.37 gm. per 100 cc. The solution contains a mixture of calcium hypochlorite and calcium chloride.

21714, 21834. *Star Water;* and **21837** *Wescco Bleaching Water.* These are disinfectant and bleaching solutions the active agent being the available chlorine which was determined to be 2.43, 2.84 and 2.89 gms. per 100 cc., in the order named. The Wescco product bore no statement of active ingredient.

20459. *Unknown material* submitted for identification was found to be copper cyanide.

20810. *Rat exterminator.* This was a preparation with a cereal or starchy base in which the active ingredient was not identified. No alkaloidal poisons were detected.

CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

Corn in Connecticut

Figure 17. Harvest time in Southern Connecticut.

The work herein reported was conducted as a joint project of the two Connecticut Experiment Stations, and therefore will appear in the Annual Reports of both Stations.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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July, 1924.

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THE WILSON H. LEE CO.
New Haven, Conn.

Corn in Connecticut.[1]

D. F. JONES, W. L. SLATE,[2] AND B. A. BROWN.[2]

Connecticut stands in the unique position of having the highest average yield of corn per acre although it is well removed from the center of largest production. In the amount of corn raised Connecticut is exceeded by 35 other states. Within the state corn occupies a greater area than any other cultivated crop. The amount of land devoted to the more important crops, in thousands of acres, is approximately as follows: hay 330, corn 67, tobacco 27, potatoes 18, other vegetables 9, oats 11, rye 5, buckwheat 2.[3] The value of the corn crop in Connecticut, worth about six million dollars in 1919, is usually exceeded about three times by tobacco, two times by hay and nearly equalled by vegetables and by fruits. The three other cereals of any importance, oats, rye and buckwheat, combined do not ordinarily amount to much more than one tenth of the value of corn. The relatively high average yield of corn per acre is due largely to the small size of individual fields, to the usually ample rainfall and the general practice of fertilizing corn liberally. The high humidity which commonly prevails during the pollination period favors a full setting of grain on the ears. All these factors tend to overcome the disadvantage of a short growing season and low temperatures during the earlier part of the growing season which retard the growth of corn.

CLIMATIC ZONES.

The southern edge of the state along the sound and considerable areas along the river valleys extending well into the state have much the same climatic conditions as the main corn growing region of the mid-west. This is shown by the biological zones, as mapped by the U. S. Biological Survey, which are based upon areas occupied by the same or closely related species of wild plants and animals. While these zones are somewhat arbitrarily defined they give perhaps the best guide to the natural climatic and soil conditions which govern the growth of plants. The upper Austral zone, as it is called, in the humid section includes practically all of Iowa, Missouri, Illinois, Indiana, Kentucky, Ohio, parts of the central states east of the Appalachian mountains and extending through New Jersey and Long Island to the area bordering the sound in New York and Connecticut and extending inland in the larger river valleys.

This explains why many of the large dent varieties from the west are often grown successfully for grain in Connecticut. But

[1]The scope of this corn survey was planned by W. L. Slate and H. K. Hayes. Much credit is due B. G. Southwick and Henry Dorsey for the location of varieties and obtaining the facts concerning their history and development.
[2]Agronomists at Storrs Station.
[3]Fourteenth Census Vol. VI, part 1, figures for 1919.

these varieties when grown for any length of time are considerably modified in size, ear shape and kernel type and in time of ripening either by direct seed selection or by natural selection. The typical western dent type favored in the past is not adapted to New England conditions. The kernels are too deep and compact on the ears to dry out well in our moist climate. The texture of the kernel is softer than our flint or smooth dent varieties, consequently the ears mold easily and the seed germinates poorly the following year. Since the smooth, hard-kerneled ears with shallow grains spaced widely on the ears have been found to give plants which ripen earlier and often yield as much or more than the compact, deep rough-grained types, these more flint like types have been favored.

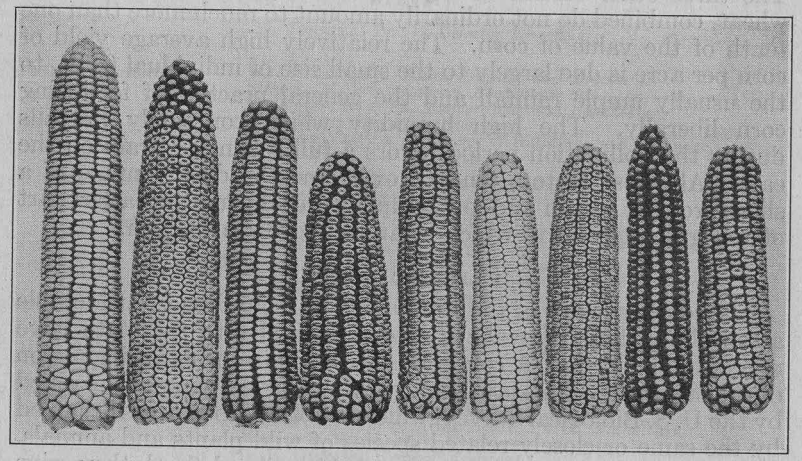

Figure 18.
Representative ears of different types of dent corn commonly grown in New England. They are from left to right; Eureka, Connecticut Dent, Century, Golden Dent, Lakeside, Sharon White Cap, Early Wonder, Holcomb's Dent and Early Huron.

Types of Corn Grown in New England.

Along with the recently introduced western varieties and the better adapted New England dent types derived from these, there are the typical eight-rowed yellow and white flint corns grown by the Indians in New England when the Mayflower landed and still widely planted. Flint corn has long been grown in this section and is well adapted to a short season and ripens when dent varieties are too wet to crib satisfactorily. The hard shallow kernels dry out quickly, consequently the seed is not easily injured by frost in the fall and germinates well the following spring. For these

reasons flint corn is the most dependable kind of corn to grow in the northern part of the state, at high elevations and in places where the frost comes early in the fall.

Many variations from the typical eight rowed flint type exist. There are very long eared varieties, others with very large seeds, and still others with small seeds having ten, twelve or fourteen rows of grain on the ear. Color varies from yellow to white in the endosperm or seed proper and from colorless to brownish or dark red in the hulls or pericarp. In addition to the typical dent and flint varieties there are a number of intermediate types having characteristics of both dent and flint corn. These have every evidence of being hybrids between dent and flint varieties which have been maintained as intermediate types.

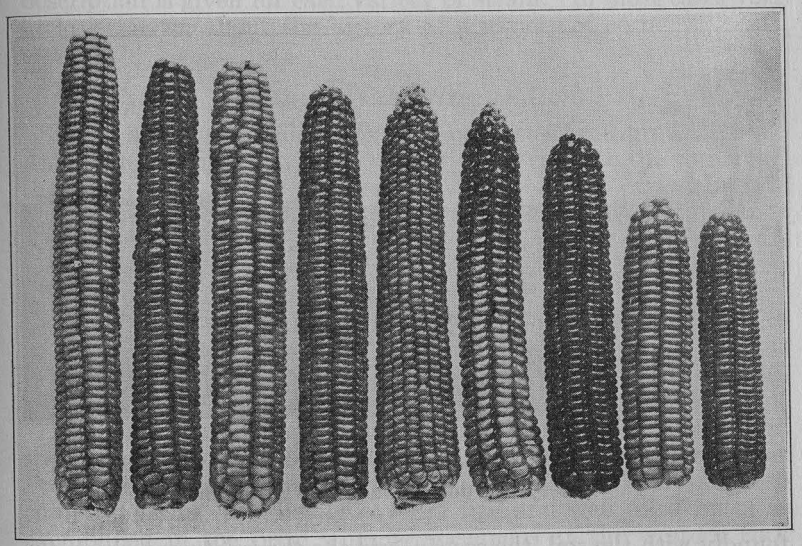

Figure 19
Types of flint corn commonly grown in New England. They are, from left to right; Sanford White, Longfellow, Mammoth White, Burwell's Yellow, Dutton, Smut Nose, King Philip, Rhode Island White Cap, and Griswold's 90 Day.

On account of its geographical position on the border line of two biological zones, with its varied topography, soils, and seasonal conditions Connecticut has probably as many distinctly different varieties of corn as any section of the country. Many of these varieties of widely different type grow equally well in any one locality. Since practically all of the corn is used on the farms where it is grown there are no market requirements to meet which in other places tend to limit the number of varieties to a few belonging to one type.

The Need of a Variety Test.

On account of the great diversity in varieties of corn grown in this part of the country it is often a problem to know which is the best variety for any particular place. In order to make an intelligent selection it is necessary to know the length of the growing season, the soil requirements and the general character of the different varieties. Many varieties suitable for silage are not at all suitable for husking. And many good varieties for grain are unprofitable to use for silage. Since there are so many differences in the varieties of corn now grown it may be expected that some varieties exist which are inherently more productive for a given locality than other varieties requiring the same length of growing season. Since corn, like every other plant, varies pro-

Figure 20.
The variety test field at the Mt. Carmel farm.

foundly with the soil, the season, and the the treatment given, the only way to find out the high yielding varieties is to grow them side by side and compare their production under equal conditions. In this way valuable material is found with which breeding operations can be conducted for the purpose of further increasing the capacity of corn to yield.

In 1914 the two Agricultural Experiment Stations, at New Haven and at Storrs, planned a co-operative corn survey and variety test. The aim was to locate the most promising varieties in every part of the state and test these long enough to find out their ability to yield in different parts of the state and their suitability for different purposes. In carrying out this plan practically the whole state has been covered and varieties located by inquiring whenever a promising field of corn was seen. The county agents have helped

greatly in giving the names and location of promising varieties. The local and state fairs have also been used to get the names of growers of corn in Connecticut. Some varieties from adjoining states have been included as well as a few from the west and south. The latter have been tested mainly for silage purposes.

On account of limitation of ground upon which the tests have been conducted it has not been possible to include every variety grown in the state. It is also quite possible that not all of the best varieties have been included. But since the test has covered nine years, new varieties being added each year, most of the better varieties have been included.

As much information as possible has been obtained concerning each variety—its origin, where grown, how selected and the purpose for which it has been raised. This together with a brief description is given for each variety or strain. In most cases very little is known about the history of a variety of corn.

Origin of Varieties of Corn.

There are many indications that corn has been grown on the American continent for many centuries previous to the coming of the white man. Corn was the principal food crop of the Indians and the main types of corn grown to-day developed in the hands of the original inhabitants. Flint corn was grown in the northeastern states and in Canada. "Gourd seed" corn, the forerunner of the modern dent type was found in Virginia and the soft floury type was employed in the west. Sweet and pop corn were used to a limited extent by some Indian tribes. How these widely different types developed and what was the wild ancestral parent of cultivated corn will probably always remain in obscurity.

Many flint varieties grown to-day differ in no essential way from specimens that have been found in prehistoric Indian remains. Probably the modern dent type with its cylindrical ear and deep compact grains, completely covered tips and well filled butts as exemplified in the prize winning specimens at the western corn shows is a recent development. It is a product both of extensive selection towards a certain standard combined with the very best conditions for growth made possible by improved methods of tillage.

The Indians were skilled in the culture of corn as shown in the reports of the early explorers. There is no way of knowing whether present day varieties are inherently more productive than those of early times. In the early chronicles, yields were never stated in terms of units of land and no distinction was made between measures of ears or of shelled grain. A competitive trial of twentieth century varieties with fifteenth century varieties would be of interest but unfortunately such a test will never be conducted. The best that can be done now is to compare the flint varieties

which have presumably changed least with dent varieties which apparently have changed most.

Very little is known as to the history and origin of the varieties grown at the present time. The common practice of changing seed and the ever present cross-pollination and natural selection which changes varieties in a few years have made it difficult to trace the history of varieties many years back. The origin of some of the most widely grown varieties in the west is typical of the way in which new varieties are developed. In 1846, Robert Reid moved from Ohio to Tazewell County, Illinois, bringing with him

Figure 21.
Flint corn has changed but little since it was grown by the Indians.

seed of a local variety known as Gordon Hopkins' corn. The first year this was planted in Illinois it did not thoroughly mature, consequently the seed did not germinate well the following year. Missing hills were replanted with an early variety known as Little Yellow corn. The corn has not been purposely mixed since then and by selection the type of Reid's Yellow dent, the most widely planted variety in this country, has been developed.

The improvement of the famous variety of corn known as Leaming was begun about 1856 in southern Ohio with the use of

several local varieties commonly grown in that region. It is stated that different kinds of corn were used including some with purple or black seeds. Leaming is one of the first dent varieties of modern type to be developed and is a truly remarkable instance of plant improvement through hybridization followed by systematic selection. To-day many different strains of Leaming are grown. There is as much difference between Leaming grown for a number of years in New England and the western Leaming as between other varieties of different origin. On account of the continual cross-pollination going on with corn and the resultant germinal heterogeneity the word variety as applied to corn cannot have the same significance as applied to other crops such as wheat, beans or tobacco, which are largely self-fertilized and generally remain true to type. The vegetatively propagated plants such as potatoes,

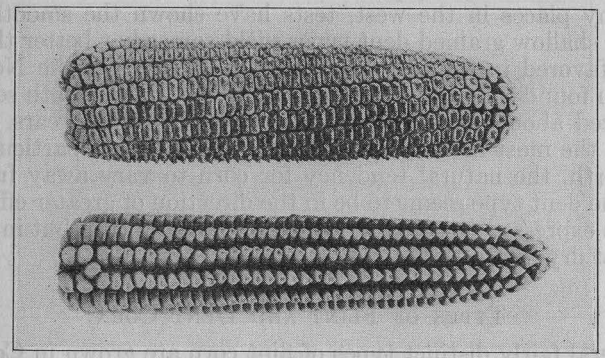

Figure 22.
Extreme types of dent corn.

berries and tree fruits also come true to type as long as they are not propagated by seed and varieties of these can be described with considerable accuracy. A variety of corn on the other hand is a collection of plants that are often exceedingly diverse. In every field of corn ears can be found which resemble many other varieties. This great variability makes it possible to select for almost any desired type, and if the selection is systematically carried out there will be a gradual change in that direction.

Smooth and Rough Grained Dent Varieties.

Many western dent varieties are being continually brought to Connecticut and grown for silage and sometimes for husking. As a grain corn they usually do not ripen early enough to be entirely satisfactory except in favorable seasons. If they continue to be grown they are naturally selected for earlier maturity. The ears

that mature properly for seed have shallower kernels, the rows of grain are spaced farther apart on the cob and the grains are smoother and harder. In other words the extreme dent type tends to become more and more flint like. Many farmers look upon this as a process of degeneration and after growing the corn for several years say that it has "run out" and get fresh seed from the west. The western seed will usually give a heavier growth of stalk because the plants mature later and in those places where such types can be brought to the hard dough stage they may be better for silage purposes than earlier ripening sorts that have become better adapted. Our tests show that the adapted varieties are superior as a general rule for grain than any varieties introduced from outside the state so far tested. While the deep kerneled, compact-eared, rough seeded dent type favored in the central corn growing states carries a large proportion of shelled corn to the ear such types do not necessarily produce the heaviest yields per acre. Even in many places in the west, tests have shown the smooth, hard seeded shallow grained dent types yield somewhat better than the types favored in the corn shows. Kiesselbach* at the Nebraska Station found that as an average of two varieties smooth seed ears produced about six per cent. more than rough seed ears. In all except the most favored corn growing sections and particularly in the north, the natural tendency for corn to vary away from the extreme dent type seems to be in the direction of greater efficiency. This is expressed not only in a better quality of corn but in greater yield of dry grain.

Types of Flint and Dent Corn.

Several fairly distinct types of flint corn are grown in Connecticut; the eight rowed, medium sized, yellow Canada flint; the reddish King Philip; the Rhode Island White Cap which is similar in type but differs in color of the grain; the ten to fourteen rowed small seeded Yellow Dutton; the long eared, eight rowed yellow Longfellow, and the similar type of Sanford White which differs in color; the large seeded, heavy cobbed Mammoth White and Mammoth Yellow flints and the still larger and coarser Gold Nugget.

Dent varieties are even more diverse and types intergrade so that it is difficult to make any clear distinction. Dent corn differs from flint in having a larger number of rows of grain on the ears and in having more soft starch in the seed. This soft starch is placed at the top of the kernels and on drying shrinks more than the hard starch at the sides and base of the kernel so that the characteristic indentation is formed in the mature seeds. In some yellow varieties this soft starch remains uncolored giving the ears a characteristic appearance generally spoken of as White Cap

*References to publications cited are given at the end of this bulletin.

corn. White Cap as applied to dent varieties should not be confused with the same term in Rhode Island White Cap Flint as in this variety the term "Cap" merely refers to the fact that the ears are usually well covered at the tips.

The dent varieties most commonly grown in Connecticut are derived from Leaming or similar types. They are characterized by medium to large tapering ears, with moderately smooth, hard kernels. The ears are not as compact as the western Leaming and carry a moderate proportion of grain to the cob. Similar varieties to these have been derived from Reid's Yellow Dent, Funk's 90 Day, Sutton's Yellow Dent, and other varieties. They vary greatly in size of ear, in the spacing between the rows and in the smoothness and hardness of the kernels. Another commonly grown type of dent is the White Cap corn. A number of varieties of this type have been secured from various parts of the state. The

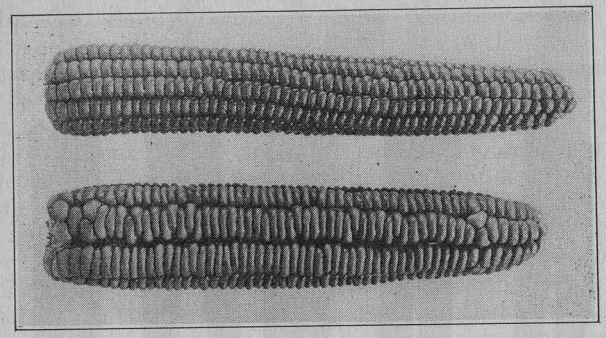

Figure 23.
Extreme types of flint corn.

ears are usually smaller than the Leaming types, but the ears carry a high proportion of grain to the cob. Many White Cap varieties ripen well and are good yielders.

Another type of dent corn is represented by such varieties as Century Dent, Early Michigan, Early Huron, Dowd Dent and other varieties. The ears are medium in size and usually tapering. The kernels are broad, smooth, hard and bright and have very little soft starch so that the indentation is not pronounced. The kernels are also shallow and rounding and there are wide spaces between the rows. These varieties ripen satisfactorily in practically every season and give good yields of high quality corn. They are well adapted to southern New England conditions. They combine many of the desirable features of flint corn with dent, habit of growth and yielding capacity.

A host of other varieties including white dents, golden dents and many other diverse kinds of dent corn are grown but cannot be

classified in any group. There are also varieties intermediate between dent and flint such as Luce's Favorite and Hickory King. The former has every indication of being a recent hybrid between dent and flint corn and is quite variable.

Source of Seed.

As far as possible seed has been obtained each year from the original grower. The practice has been to obtain from ten to twenty ears at harvest time either from the stalks in the field or from the crib shortly after husking. No extensive selection of

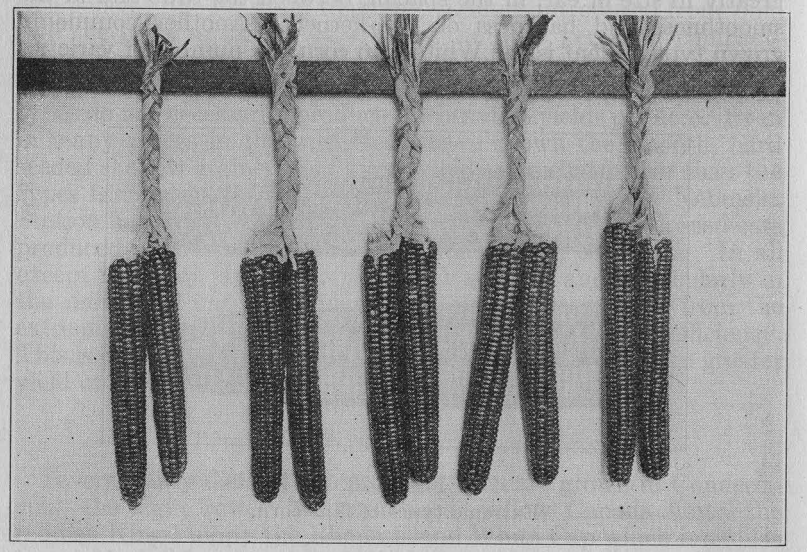

Figure 24.
One farmer's method of hanging seed ears.

seed ears was made, the endeavor being to obtain good ears representative of the variety, such as the grower would sell for seed if he were putting out any quantity. The seed ears in most cases were not show ears but were generally as good as the grower would use for his own planting. Experience has shown that there is very little correlation between the appearance of the seed ears and the crop grown from them. Since ten or more ears were obtained from different parts of the field, seldom more than one ear from a shock, it is thought that the seed represented the variety fairly. Most of the seed from out of the state was sent by the grower or dealer and was already shelled. Nothing is known as to how this seed was selected. Enough seed was ob-

tained in each case so that it was fairly representative of the variety.

Whenever one year old seed was not available two year old seed has been used but in no case has seed older than this been used. It is hardly necessary to say that no seed was saved from the trial plots since cross-pollination alters the nature of the crop grown from that seed so that it would no longer represent the variety. The seed ears were dried in a heated room and stored above freezing temperature. When thoroughly dried all the ears of one variety were shelled together and the seed well mixed. It was then divided, one half being used for planting at the farm of each Station.

Where the Tests Were Conducted.

The Mt. Carmel farm is situated about ten miles inland from the shore at a moderate elevation on soil that is classified as Wethersfield Sandy Loam. The air drainage is such that the corn is seldom damaged by the first frosts in the fall. The growing season is therefore extended a week or more beyond the time that corn is frosted in the adjacent valleys.

On this farm corn has been planted from the 20th to the 25th of May and cut during the latter part of September or first half of October. The land used for the corn variety tests is typical of much of the upland soil in Connecticut and is fairly representative as to fertility. The fields have been rotated with various other crops, principally clover and timothy and potatoes. Corn has usually been grown two years in succession. About ten tons of manure to the acre have been used together with applications of commercial fertilizer of about a thousand pounds per acre of a 4-8-4 formula although the amounts and composition have varied from year to year. The aim has been to have the corn land representative of the average corn land in the state in fertility.

The station farm at Storrs is in the eastern highland 35 miles from the sound. The soil is Gloucester Fine Sandy Loam, a well drained soil of rather low natural fertility. It is typical of much of the eastern portion of the state. The air drainage is good and corn is not affected by the earliest frosts. The rotation and fertilization practice has been much the same as at Mt. Carmel. The two places in different parts of the state and in different biological zones make possible an interesting comparison of the behavior of the same varieties grown under different conditions.

Method of Testing the Varieties.

The plan has been to grow each variety in both places at least three years. Since varieties perform differently in different seasons it is necessary to have more than one year's results upon which to base reliable conclusions. In some cases varieties have

shown up so poorly the first or second year grown that it has not seemed worth while to test them further so they have been dropped. In many cases it has been impossible to secure seed because the farmer stopped growing the variety and no other source of similiar seed could be located. In general the practice has been to continue every variety that ripened satisfactorily and of which a supply of seed seemed assured, for at least three years. The more promis-

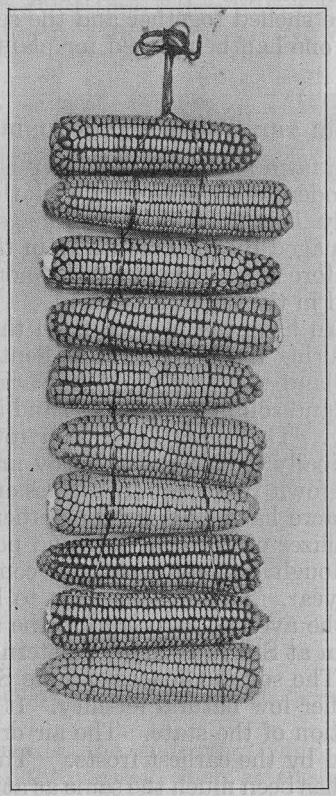

Figure 25.
A convenient method of hanging seed ears.

ing varieties were grown throughout the experiment while those that yielded poorly or were unsatisfactory for other reasons were discontinued after being tested three years. However the number of years a variety has been grown is not a reliable index of its desirability as many good varieties were not included in the test until the later years.

Planting System.

The usual practice has been to plant each variety in single row plots, grouping together varieties of the same type, size and length of growing season. Each variety has been planted in at least two plots in different parts of the field and as far as possible the plantings have been replicated three times. Single row plantings are subject to a competitive effect which is not present when the varieties are grown by themselves. A tall, large, late growing variety planted along side of a smaller and earlier variety will tend to have an advantage because it will receive more sunlight and will have less root competition than it would have growing in a field planted to this one variety. Consequently its yield may be higher than it would otherwise be. In the same way the yield of the smaller variety may be reduced below what it would be if it were not competing with the larger variety. Kiesselbach at the Nebraska Station compared two widely different varieties of dent corn and found that the larger and later variety in the single row trials yielded 105 per cent. more than the other variety whereas, when planted in blocks of three rows and the yield based only on the center row, it yielded only 52 per cent. more as an average of two years' trials. However, this example is an extreme case. Varieties of similar habit of growth do not show such a competitive effect. In 1915 three row plots were used at both stations. If there was a pronounced competitive effect between adjacent rows of different varieties the yields of the large and later varieties in the outside rows of the three row plots would tend to be higher, while the yield of the smaller and earlier varieties would be lower, than the center row of each plot which is presumably free from influence by the other variety. Consequently the yields of the two outer plots should be more variable than the yield of the center plot for the variety test field as a whole. The coefficients of variability calculated for each of the three rows for 69 varieties are 13.93 ± 1.75 and 15.01 ± 1.89 for the two outer rows and 13.93 ± 1.75 for the center row. In this case there was no significant difference so there was apparently no marked competitive effect. For this reason the three row plots were not used after 1915. Planting in single rows permitted more replications. The order in which the varieties were planted was changed in each replication so that the same varieties were not grown adjacent to each other. Flint and dent varieties were grown separately with a guard row where plots adjoined. For these reasons it is believed that competitive effect is not a serious factor for error in these trials although in some cases it has tended to exaggerate the differences. In any case there can be no effect unless the varieties differ in capacity to produce and it was mainly to establish this fact of a difference in varieties that the corn survey and variety trials were conducted.

Cross Pollination.

Since all of the varieties were grown in the same field, cross pollination took place freely between varieties which tasseled and silked at the same time. This was shown by the large number of yellow kernels produced on white seeded varieties. Cross-pollination can have no effect upon the plant itself but it does effect the seeds immediately resulting from the cross-pollination. Of course the plants grown from these crossed seeds would be greatly altered but since no seed was saved from the test fields this can be left out of consideration. A number of investigators have shown that cross-pollination between different varieties increases the weight of the crossed seeds as compared to the self-pollinated seeds on the same ears and this tends to increase the yields in mixed plantings.

Figure 26.
Variation in size of different varieties of dent corn.

Carrier compared the yield of four strains of Boone County White corn from different sources grown separately and mixed together. The four strains when grown in such a way that inter-pollination was prevented gave an average of 20.9 bushels per acre while an equal mixture of seed of the four strains yielded 32.4 bushels in a two year test. Similarly four strains of Leaming grown separately gave 26.0 and in mixture 40.4 bushels. It is difficult to account for these large increases of 55 per cent in each case as due to hybrid vigor in the seed. Kiesselbach has made a very careful comparison of cross and self-pollinated seeds on the same ears from a number of different varieties and found an increase of only 22 hundredths of one per cent.

Results obtained at the Connecticut Station show that increase in the weight of seed due to cross-pollination is an indication that

the plants are poor yielders. Cross-pollination between inbred strains that were much reduced in yield gave increases ranging as high as 35 per cent. Cross-pollination between first generation hybrids which were vigorous and yielded well gave smaller increases in weight of cross-pollinated seeds not exceeding ten per cent whereas the highest yielding type of all did not give any increase in weight when cross-pollinated with a distinctly different variety. If this is generally true, mixed plantings as in variety tests would tend to increase somewhat the yield of the poorer-yielding varieties and in this way might be misleading. It seems more probable that the increased yield from mixed plantings is due to a more complete pollination and consequently a heavier setting of seed rather than increase in weight of seeds due to hybrid vigor. This would affect all varieties alike presumably except the earliest and latest varieties.

Planting, Harvesting and Computing Yields.

The varieties grown for grain have been planted in hills three feet apart each way and thinned to three stalks to the hill. The plots have varied from 66 to 150 feet in length in different years according to the size of the field and the number of varieties planted. The corn was cut as soon as ripe and put into shocks. When husked and weighed a sample of about 15 pounds was taken from each lot and dried in a steam heated room to a constant weight. A composite sample was then taken from all the varieties to find the amount of moisture still remaining. From this the yield in bushels of shelled corn per acre with 12 per cent moisture was calculated for each plot, using 68 pounds of ear corn equivalent to one bushel of shelled corn. Throughout the test field every fifth plot was planted with one variety as a check to indicate differences in productiveness in different parts of the field. The theoretical check yield was calculated for each row from the yields of the two check plots on each side by increasing or decreasing the difference uniformily in the intervening rows. At Mt. Carmel the difference in the yield of the variety and the theoretical check yield was then added to or subtracted from the average of all the check rows to give the final yield. This procedure may be illustrated as follows:

Plot Number	Corn Grown	Actual Yield	Theoretical and Actual Check Yield	Difference between actual yield of corn tested and theoretical yield of check.	Corrected yield obtained by adding or subtracting this difference to the ave. of all check plots grown
1	check	50	50	0	52.5
2	variety A	75	51	+24	76.5
3	variety B	70	52	+18	70.5
4	variety C	40	53	−13	39.5
5	variety D	50	54	−4	48.5
6	check	55	55	0	52.5

In this way the yields obtained in one part of the field can be compared with the yields in other parts of the field. After correcting for place variation in this way the yields of the different plots of the same variety have been averaged. At Storrs the actual yields were compared with the theoretical check yields on a percentage basis.

In the silage test the varieties have been planted in drills, at Mt. Carmel, spacing the plants one foot apart in the rows, with the rows three feet apart. The varieties were cut at different times as they matured. At Storrs all varieties were planted in hills and cut at the same time which was usually shortly before or shortly after the first killing frost. The plants were weighed as soon as cut

Figure 27.
A field of flint corn in Kent.

in the field and a sample obtained by taking every tenth stalk in the row. This was chopped and dried to absolute dryness and the per cent of moisture calculated from this. The yield in green weight per acre was obtained for each plot, corrected to the check plots and averaged. The yield of dry matter per acre was then calculated by multiplying this average by the average per cent of dry matter in the samples of that variety.

Discussion and Analysis of the Results.

The results obtained from growing the varieties at Mt. Carmel and at Storrs from 1914 to 1922 are given in the accompanying tables. The number of years tested, the color of the seed, the relative maturity, the actual yield in bushels of shelled grain per

acre and the relative yield are given for the dent and flint varieties grown for grain at Mt. Carmel. At Storrs, in addition to these data, figures were also obtained for the production of stover, the per cent of dry matter in the ear corn at harvest and the per cent of soft corn. As would be expected the yields of all varieties varied with the season. For example, the highest yield obtained at Mt. Carmel during the nine years of the test ranged from 59 bushels in 1920 to 114 bushels in 1917. Since the varieties were not all grown in the same years the only way to compare them fairly with each other is to calculate their yield relative to the yield of some one variety grown every year. This has been done, using Burwell's Yellow Flint as the standard of comparison because it ripened every year and was well adapted to the conditions at both places. It was used as the check for the flint varieties at Storrs and Mt. Carmel and its yield is based on an average of a large number of plots. The relative figures given in the tables are the percentage ratings based on Burwell as 100. In the case of yield, for example, the relative yield is obtained by dividing the actual yield of each variety by the yield of Burwell for that year with the result stated as percent. The relative yield for each year is then averaged to give the final relative yield given in the tables. A relative yield above 100 indicates to what extent the variety surpassed Burwell's Yellow Flint in yield of grain while a result below 100 indicates a correspondingly inferior yield.

The number of days which a variety requires to mature can not be determined with any great degree of accuracy. The method used was to go thru the field at stated intervals during the ripening period and note all varieties that were ready to be cut and put in the shock. This was determined when most of the ears were well glazed, the lower leaves drying and the husks turning yellow. Usually one observer took the notes on maturity for all the varieties so that the results are comparative. Since the time of maturity varied with the seasons it is necessary to state maturity relative to some one variety as in the case of yield. The relative times to mature for each variety for each of the years it was grown have been calculated and averaged. Based on these averages all varieties have been classified as early, medium, late or very late according to an arbitrary number of days. This scale was determined by classifying all the varieties in fairly even sized groups. The scale is the same for both dent and flint varieties grown for grain at both Storrs and Mt. Carmel. A different scale was used for the silage varieties. No great accuracy is claimed for this method of classification but it is thought the results would be more useful stated in this way rather than in actual number of days required to mature. All varieties that matured in approximately 117 days or less are classed as early, those between 118 and 126 as medium, between 127 and 135 as late and all that required more than 136 days as very late. Since

the corn was planted about the twentieth of May each year this means that the early varieties were mature about September fifteenth on the average. The medium varieties matured around the twenty-fifth, the late varieties about the first week in October. Any varieties maturing later than that or which did not mature before frost are classed as very late. These are average results. In some seasons all varieties required a longer period of time to ripen than they did in other seasons.

On account of the variability of the fields on which these tests were conducted and the great fluctuation from season to season it is extremely difficult to get reliable results upon which to base a comparison of varieties. Although the use of check plots tends to correct for soil differences and calculating the yields relative to a

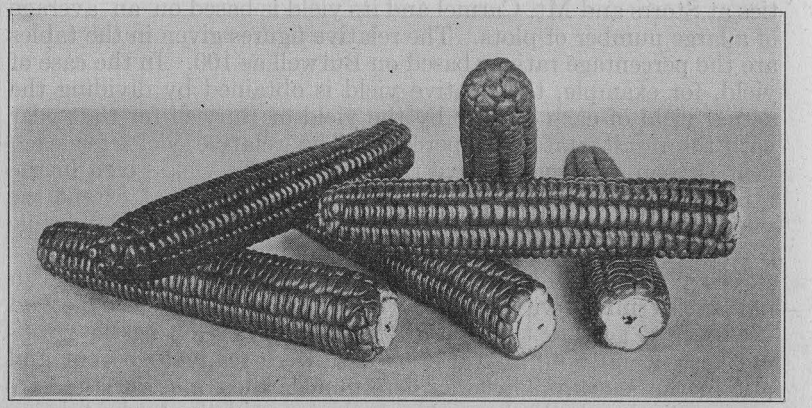

Figure 28.
An early type of flint corn.

single variety tends to offset seasonal variation it is certain that varieties react differently in different situations and in different seasons. Variation in the stand of plants and plot competition all enter as factors to make the results erratic. Another serious problem in variety tests is the rate of planting. Mooers at the Tennessee Station and others have shown that there is an optimum rate of planting for each variety and that this varies with the productivity of the soil and season. In general mall growing varieties give their best yields when planted thick while larger varieties must be planted more thinly to give their best results. In a test of a large number of varieties it has been impossible to plant the varieties at different rates. The rate used, three plants to a hill spaced three feet apart each way, had been shown to give the best results for many of the varieties grown in Connecticut and so was used. But it seems apparent that many of the

larger varieties were handicapped at this rate of planting. For all of these reasons small differences in yield do not necessarily indicate any real differences in yielding ability, particularly in varieties that have been tested less than three years.

Productiveness of Flint Varieties at Mt. Carmel and Storrs.

Many varieties which give the highest yields at Mt. Carmel are also good producers at Storrs in spite of the fact that the differences in soil and season tend to make varieties behave differently in the two places. For this reason the tests show real differences in yielding capacity. In all, 62 varieties of flint corn were grown at Mt. Carmel. Of these 38 were grown three years or more. At Storrs 72 flint varieties were grown and of these 44 were tested three years or more. In the list of the 20 highest yielding flint varieties at Mt. Carmel, tested for three years or more there are 15 which are also in the list of 20 highest yielding flint varieties at Storrs. Therefore three out of four are among the highest yielders in both places, whereas by pure chance alone less than one out of four would be found on both lists.

Highest Yielding Flint Varieties.

Those varieties that are among the highest yielders at both places are given in italics. All varieties are listed alphabetically and not in order of their productiveness:

GROWN AT MT. CARMEL	GROWN AT STORRS
Avery's White Flint	*Bacon's Gold Nugget*
Bacon's Gold Nugget	*Behan's Longfellow*
Behan's Longfellow	*Bissell's Yellow Dutton*
Bissell's Yellow Dutton	*Burwell's Yellow Flint*
Burwell's Yellow Flint	Chace's Yellow Flint
Frost's Yellow Flint	*Frost's Yellow Flint*
Gelston's Longfellow	Griswold's Canada Yellow
Ibsen's Yellow Flint	Hauschild's Yellow Flint
Keeler's Longfellow	Healy's Yellow Flint
Mammoth White Flint	*Keeler's Longfellow*
McLean's Flint	*Mammoth White Flint*
Mosher's Longfellow	*Mosher's Longfellow*
Pied Flint	*Pied Flint*
Purdy's Gold Nugget	*Purdy's Gold Nugget*
R. I. Exp. Station's R. I. White Flint	*R. I. Exp. Station's R. I. White Flint*
Sanford White Flint	*Sanford White Flint*
Skilton's Smut Nose Flint	*Skilton's Yellow Flint*
Skilton's Yellow Flint	Stickney's Yellow Flint
U. S. Dept. Agric. No. 193	*U. S. Dept. Agric. No. 193*
Zwick's Yellow Flint	*Zwick's Yellow Flint*

Productiveness of Dent Varieties at Mt. Carmel and at Storrs.

In all, 70 varieties of dent corn were grown at Mt. Carmel and 69 at Storrs. Of these 36 and 37 respectively were tested three years or more. Of the 20 highest yielding dent varieties at Mt.

Carmel 14 are also among the 20 highest at Storrs. Here again nearly three out of four of the high yielders are the same varieties in both places where the chances, if all varieties were potentially equal, would be about one in four. Among six high yielding varieties at Mt. Carmel that are not in the high yielding list at Storrs there are four that were late varieties from the southern part of the state or farther south that did not ripen well at Storrs. On the other hand four of the six high yielders at Storrs not represented at Mt. Carmel are medium or early varieties from the central or northern part of the state and for that reason might not be expected to yield well at Mt. Carmel.

Highest Yielding Dent Varieties

Those varieties that are among the highest at both places are given in italics. All varieties are listed alphabetically and not in order of their productiveness.

GROWN AT MT. CARMEL	GROWN AT STORRS
Beardsley's Leaming	*Beardsley's Leaming*
Brewer's Dent	*Century Dent*
Century Dent	*Dowd Dent*
Connecticut Dent	*Early Michigan*
Cornell No. 11	Hamilton's Leaming
Dowd Dent	*Herr's White Cap*
Early Michigan	Hickory King
Funk's 90 Day	Johnson's Yellow Dent
Herr's White Cap	*Lakeside Dent*
Klondyke	*Lanterman's Leaming*
Lakeside Dent	*Luce's Favorite*
Lanterman's Leaming	*Northern White Dent*
Luce's Favorite	Peck's Yellow Dent
Minnesota White Cap	Prince's Leaming
Northern White Dent	Sharon White Cap
Silver King	*Silver King*
Sutton's Dent	*Sutton's Dent*
Tryon Dent	*Tryon Dent*
Vinehill Leaming	*Vinehill Leaming*
Webber's Dent	*Webber's Dent*

The high yielding varieties of both dents and flints were somewhat later in maturing on the average than the general run of varieties. There were no early dents in the list of 20 highest either at Storrs or Mt. Carmel. Among the 20 flints there were five early varieties at Storrs and three at Mt. Carmel. Most of the high yielding varieties were medium in time of ripening. The correlation between number of days to mature and yield is rather high when the dents and flints are considered together, the co-efficient of correlation being $+.580 \pm .035$ for the Storrs data. For the flints alone the correlation co-efficient is $+.416 \pm .039$ and for the dents alone, $-.039 \pm .050$. The lack of correlation in the latter case is due to the fact that many late varieties did not mature properly and yielded poorly for that reason. The high correlation for the dents and flints together is due to the fact that the dents as a class ripen later than the flints and yield correspondingly more.

Quality of Husked Corn.

With regard to quality of husked corn the high yielding varieties are surpassed by some early ripening sorts as might be expected. Data were obtained at Storrs on the amount of moisture in the ear corn at husking and the proportion of soft corn, which includes all corn that is immature, moldy and otherwise unfit to crib well. These figures for the dents and flints calculated on the percentage basis relative to Burwell are given in the accompanying table.

Comparison of the Highest Yielding Dents and Flints with all Varieties in Relative Amount of Dry Matter and Soft Corn.

	Relative per cent dry matter in ear corn.	Relative amount of soft corn
Average of 20 highest yielding dent varieties	90	820
Average of all dent varieties	92	579
Average of 20 highest yielding flint varieties	98	299
Average of all flint varieties	100	174

In general, therefore, it is apparent that a high yielding variety will be obtained with some sacrifice in quality of corn and with some risk as to maturity. None of the high yielding dents are in the class of early varieties. On the other hand some of the highest yielding varieties are below the average in the proportion of soft corn. In the amount of stover produced the twenty highest dents and flints at Storrs, where the data were taken, are above the average as would be expected, as a vigorous growth with large stalks and leaf surfaces is necessary to make large yields.

Varieties for Silage.

Since many varieties of corn are grown for silage which do not mature properly for husking a separate test of corn for silage has been made at both Storrs and Mt. Carmel. The method of planting the varieties with the use of check and guard rows has been the same as with the other varieties. Enough seed was used to insure as nearly perfect a stand of plants as possible and the excess seedlings thinned out as soon as large enough to be pulled. As explained before, the entire stalks from each plot were weighed in the field as soon as cut and a sample taken to determine the amount of moisture in the corn as it would go into the silo. Yields are based on the total amount of dry matter produced.

Seventy-eight varieties were tested for silage purposes at Storrs of which 26 were grown three years or more. Of the total number 6 varieties were flints. The others were dents with the exception of a few varieties like Hickory King and Luce's Favorite which are intermediate in type. At Mt. Carmel 46 varieties were tested, 21 being grown three years or more. Five varieties of flints were included.

HIGHEST YIELDING SILAGE VARIETIES.

Those varieties that are among the highest at both places are given in italics. All varieties are listed alphabetically and not in order of their productiveness.

GROWN AT MT. CARMEL	GROWN AT STORRS
Beardsley's Leaming	*Beardsley's Leaming*
Brewer's Dent	Dowd Dent
Eureka	Early Michigan
Funk's 90 Day	*Eureka*
Gelston's Ensilage	*Funk's 90 Day*
Griswold's White Cap	Hickory King
Klondyke	*Klondyke*
Lakeside	*Lakeside*
Luce's Favorite	Leaming (W. H. Strong)
Mastodon	*Mastodon*
Northern White Dent	*Northern White Dent*
Webber's Dent	Sutton's Dent

The accompanying list of 12 highest yielding varieties at Storrs and Mt. Carmel is based on the percentage rating giving the yield in dry matter per acre relative to the yield of Eureka stated as 100 per cent. If we consider only the highest yielding six varieties at both places, which is roughly one-fourth of the number of varieties grown three years or more, we find that four varieties are included on both lists. Since the expectancy on the basis of random distribution is less than one in sixteen because not all varieties were grown at both places it is apparent that the test has brought out actual differences in yielding capacity.

At both Storrs and Mt. Carmel, Eureka has given the highest average yield of dry matter per acre of all varieties, with Mastodon second. These late maturing southern grown varieties make a large vegetative growth but seldom go beyond the milk stage at Storrs. At New Haven the grain frequently reaches the soft dough stage and in some years many of the ears are glazed. However, the proportion of grain is always low even under the best conditions. The leaves also frequently die and fall off the lower half of the stalks due to the dense shading so that the silage is largely made up of stalks. As the corn goes into the silo the per cent of dry matter is lower than the average of all varieties tested as follows:

	Per cent Dry Matter.	
	Storrs	Mt. Carmel
Eureka	20	27
Mastodon	20	29
Average of all varieties	26	31

It is therefore apparent that these late varieties make silage that is bulky but low in actual food value. Eureka silage is higher in water and crude fiber and lower in protein, sugar, starch and fat than earlier maturing varieties. However, the greater production of dry matter per acre tends to make up for this but the amount of some of the ingredients per acre produced by Eureka

and Mastodon is still below the production of varieties that regularly reach the dough stage as shown by the data at Storrs.

PRODUCTION IN POUNDS PER ACRE OF THE PRINCIPAL INGREDIENTS OF SILAGE FROM DIFFERENT VARIETIES.

	Ash	Crude Protein	Crude Fiber	Nitrogen Free Extract	Fat	Total Dry Matter
Eureka	361	490	2455	5244	108	8658
Mastodon	372	569	2087	5087	132	8247
Leaming	307	623	1792	5244	195	8161
Pride of the North	246	505	1326	4353	169	6599

As producers of starch and sugar (nitrogen free extract) and mineral matter (ash) the very late varieties are equal to any varieties but are deficient per unit of area in protein and fat.

There is also the question of comparative palatability and digestibility of the silage which obviously cannot be answered save by feeding the silage and noting the result. This has been done at the Storrs Station and the results have been reported by Slate, White and others. The experiment was carried out by growing three different types of corn—early, medium and late—and feeding the silage of these varieties separately to three different lots of milk cows. The varieties chosen were: Pride of the North, as a variety which regularly reaches the hard dough stage at Storrs; Leaming, from seed grown in Ohio which reaches the soft dough stage and makes a large stalk growth; and Eureka, a southern white variety from seed grown in Virginia, which seldom has time to grow beyond the blister or milk stage. All animals were fed the same amount of silage supplemented with hay. The amount of grain fed was varied to maintain constant weight. The results are summarized by the authors as follows:*

1. "Silage from the Early Maturing (Pride of the North) corn has a superior feeding value for milk production to the Late Maturing (Eureka), while the Medium Maturing (Leaming) lies intermediate. The dry matter content of the Leaming is almost exactly halfway between the other two and likewise the feeding value proved to be about halfway between. This is clear when it is stated that with Early silage 28.57 pounds of grain was required to produce each hundred of milk, being 9.74 pounds less than for Late and 4.76 less than for Medium."

2. "Due to the larger acre yields of Late and Medium, they will produce more food and hence more milk per acre than the Early maturing corn. The Late has the advantage in this respect, although to procure 500 pounds more of milk it was necessary to handle four tons more of silage in and out of the silo. On land where Early will yield 69 per cent. and where Medium will yield 85.6 per cent. as much as Late, they are on even terms in production value. Our yields of Early and Medium were 60 per cent.

*Storrs Agric. Exper. Station Bull. 121, 1924.

and 80 per cent. respectively of the tonnage of Late. About 1.2 acres of Early and 1.1 acres of Medium were, therefore, required to equal one acre of Late in feeding value."

3. "These results justify the use of the Late maturing, high yielding varieties of corn on the intensive dairy farms of northern and northeastern United States. However, where saving of other feeds is primary, the Medium corn of good yielding capacity, which reaches the dough stage before harvesting is nearly equal to the Late in acre milk production value, and ton for ton it will produce milk at a 13 per cent. saving of other feeds. But the Early maturing varieties will generally lose out in intensive dairy sections because of their low yield, even though they are more valuable ton for ton."

4. "The solution of the problem will doubtless be found in this statement: On farms where the price of milk is low and it is desired to save as much grain as possible, Medium should pay best; but on a farm where the available corn land is limited and the price of milk reasonably high, Late should pay best."

Comparison of Dent and Flint Corn.

Many things must be taken into consideration in comparing dent with flint varieties of corn with regard to their suitability for grain and fodder production. The principal points to be considered are maturity, yield, quality of grain, character of fodder and germination of the seed. Both tests at Storrs and Mt. Carmel show that the flint on the average matures earlier than the dent corn. There is a difference of seven per cent. in favor of the flints at both places when maturity is given a percentage rating relative to the maturity of one variety grown throughout the test. On the other hand the dents yield more as might be expected since they have a longer growing season. At Storrs all of the dents average 58 bushels, the flints 55 bushels. At Mt. Carmel the yields were 62 to 59 in favor of the dents. To answer the question as to whether or not there is any difference in the relative efficiency of the two types, that is, the rate production in a given time, medium ripening dents are compared with flints which had the same length of growing season. Only varieties grown three years or more are used. Twenty-two flints averaged 55.4 and 23 dents averaged 59.8 bushels at Storrs. This is a difference of 7.9 per cent. in favor of the dents. At Mt. Carmel comparing varieties of the same growing season, 33 flints averaged 59.1 and 20 dents averaged 65.3 bushels. This is a difference of 10.5 per cent. in favor of the dents. Taking all varieties and dividing the relative yield by the relative number of days to mature we get 0.990 and 0.924 per cent. for dents and flints respectively at Storrs and 0.971 and 0.940 at Mt. Carmel. These figures are the average production per day relative to the standard variety with which they are all compared. It is thus

seen that on the basis of production per day the dents are somewhat more efficient than flints.

To offset this advantage the flints are more certain producers and over a period of years will ripen their crop more consistently than will the dents. In unfavorable seasons the highest flints will outyield the highest yielding dents. Moreover, all but the very late varieties of flint corn will practically always ripen sufficiently to crib well whereas many of the later dent varieties occasionally will not ripen satisfactorily. Flint corn has less soft corn and consequently has somewhat greater feeding value. Also flint corn seed will often germinate better unless special precautions are taken to store dent corn so that it will dry thoroughly before freezing weather.

Figure 29.
Upland situations usually escape the first fall frosts and consequently can mature later varieties.

The large kernels and hard texture of flint corn are objectionable for some purposes and the larger number of ears per plant and the stronger shanks make the labor cost of harvesting flint corn greater. Flint corn produces more stalks from the same amount of seed and the stalks are more slender. Consequently flint corn fodder is more preferred than dent, more of it is eaten and the refuse stalks are less difficult to handle in the manure.

Comparison of Yellow and White Corn.

Investigations conducted at the Wisconsin Station and elsewhere show that yellow corn has a slightly greater feeding value than white corn, due to a higher vitamine content. This is shown most clearly by pigs which do not have access to green pasture. Cattle and horses fed clover, alfalfa hay or silage show no difference in

the feeding value of yellow or white corn. These experiments have been conducted with western dent corn. It is not established that white flint corn is less valuable than yellow flint corn for feeding purposes. Since both colors in flint corn are about equally common there seems to be no popular prejudice against white flint corn. In contrast to this very few purely white varieties of dent corn are grown in New England. In productiveness yellow and white corn are equal. At Mt. Carmel 58 yellow dent varieties averaged 105.9 and six white dent varieties average 106.8 per cent. relative yield. Forty-seven yellow flints altogether gave a yield

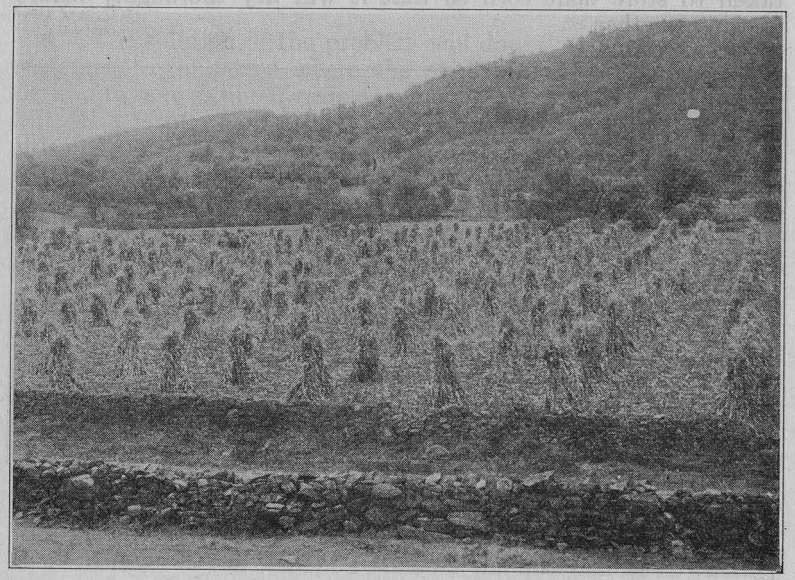

Figure 30.
In the valleys corn must mature before the first fall frosts.

of 91.4 and 15 white flints 91.8 per cent. These differences are too small to be significant.

Recommended Varieties.

Varieties which yield well in the southern part of the state will not ripen in the more northern parts at higher altitudes. On the other hand early varieties which ripen in the short season localities do not yield as well as later varieties where the season is longer. Also varieties differ in their adaptability to different soils and crop rotations. An attempt has been made in the accompanying map to divide the state arbitrarily into five districts and to compile a

list of varieties which will most likely do well in their respective districts. The districts are numbered in order of the length of growing season, number one in general requiring the earliest maturing varieties and five the latest. Since the varieties were tested in only two of these districts their behavior in the other districts cannot be stated except as they have already been grown there. Moreover corn which is taken from one district and tested in another may not show its value for its own district. But since there are a number of varieties from other districts that yielded well in both districts I and V it is thought that they will do well in other places where they are not now commonly grown.

For these reasons it should be clearly understood that the lists of recommended varieties are suggestive only. All new varieties should be carefully tried in the locality where they are to be grown. Many trials of this kind have been conducted by the Farm Bureaus in the various districts and much information is already available as to suitable varieties.

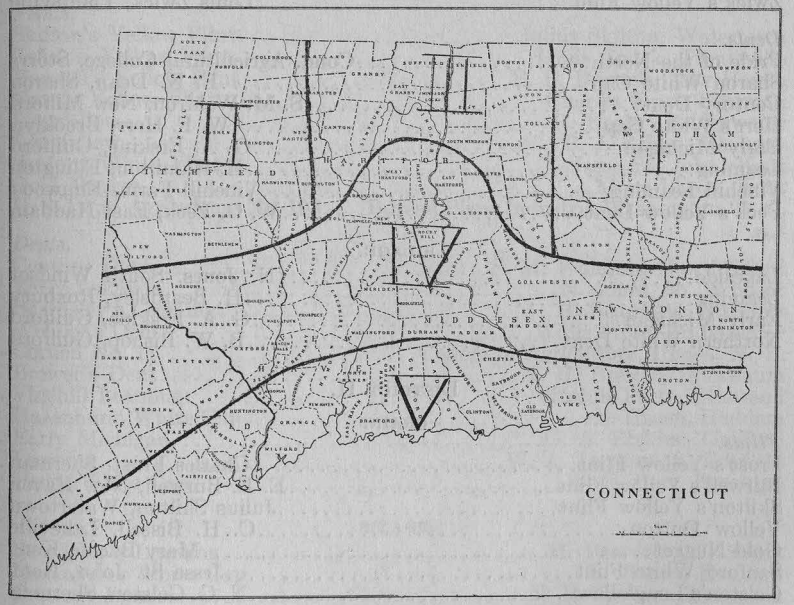

Figure 31.
Connecticut divided into five arbitrary corn growing districts according to the length of growing season.

The following high yielding varieties and strains seem to be well adapted for the districts indicated and shown on the map. It must be borne in mind that these sections cannot take into consideration all differences in soil, altitude and climate. The varieties listed for each district cannot all be grown successfully in all parts of the district. Some of the varieties have not been grown in the district for which they are recommended so that their adaptation to that district is not proven. The varieties are listed approximately in order of their earliness.

District I.

GRAIN.

Flints.

Rhode Island White Cap	R. I. Exp. Station, Kingston, R. I.
Canada Yellow Flint	Griswold & Sons, So. Wethersfield
Skilton's Yellow Flint	Julius Skilton, Watertown
Burwell's Yellow Flint	E. E. Burwell, New Haven
Healey's Yellow Flint	L. H. Healey, Woodstock
Stickney's Yellow Flint	L. J. Grant, Wapping
Zwick's Yellow Flint	Louis Zwick, Plantsville

Dents.

Pride of the North	Conn. Agricultural College, Storrs
Sharon White Cap	E. K. Dean, Sharon
Century Dent	S. M. Waldron, New Milford
Herr's White Cap	W. F. Herr, Brooklyn
Early Michigan	G. A. Erskine, Guilford
Leaming	H. Hamilton, Ellington
Vinehill Leaming	Vinehill Farm, Elmwood
Peck's Yellow Dent	W. O. Peck, East Haddam

SILAGE.

Lakeside	N. Jones, South Windsor
Leaming	H. Beardsley, Roxbury
Early Michigan	G. A. Erskine, Guilford
Northern White Dent	B. W. Bishop, Guilford

District II.

GRAIN.

Flints.

Frost's Yellow Flint	Charles Frost, Sherman
Burwell's Yellow Flint	E. E. Burwell, New Haven
Skilton's Yellow Flint	Julius Skilton, Watertown
Yellow Dutton	C. H. Bissell, Lakeville
Gold Nugget	Mary Bacon, Kent
Sanford White Flint	Jesse St. John, Kent
Gelston's Longfellow	N. G. Gelston, Sherman
Mosher's Longfellow	N. R. Mosher, Sherman

Dents.

Sharon White Cap	E. K. Dean, Sharon
Century Dent	S. M. Waldron, New Milford
Webber's Dent	Willis Frost, Bridgewater
Beardsley's Leaming	H. Beardsley, Roxbury

SILAGE.

Same as District I.

District III

GRAIN.

Flints.

King Philip	W. E. Price, Warehouse Point
Hill's Red Flint	S. F. Brown, Windsor
McLean's Flint	J. B. McLean, Simsbury
Stickney's Yellow Flint	L. J. Grant, Wapping
Healey's Yellow Flint	L. H. Healey, Woodstock

Dents.

Hasting's Yellow Dent	W. S. Hastings, Somers
Early Lakeside	N. Jones, So. Windsor
Pride of the North	Storrs Agricultural Experiment Station
Century Dent	S. M. Waldron, New Milford
Leaming	H. Hamilton, Ellington
Herr's White Cap	W. F. Herr, Brooklyn

SILAGE.

Same as District I.

District IV.

GRAIN.

Flints.

Skilton's Yellow Flint	Julius Skilton, Watertown
Zwick's Yellow Flint	Louis Zwick, Plantsville
Burwell's Yellow Flint	E. E. Burwell, New Haven
Frost's Yellow Flint	Charles Frost, Sherman
Longfellow	R. Keeler, Bridgewater
Longfellow	P. J. Behan, Roxbury
Sanford White Flint	Jesse St. John, Kent
Gold Nugget	Mary Bacon, Kent
U. S. Dept. Agriculture No. 193	Bureau Plant Industry, Washington, D. C.

Dents.

Century Dent	S. M. Waldron, New Milford
Early Lakeside	N. Jones, So. Windsor
Beardsley's Leaming	H. Beardsley, Roxbury
Webber's Dent	Willis Frost, Bridgewater
Cornell No. 11	College of Agriculture, Ithaca, N. Y.
Brewer's Dent	N. H. Brewer, Hockanum
Vinehill Leaming	Vinehill Farm, Elmwood
Hazenhurst White Cap	E. Hazen, Haddam
Early Michigan	G. A. Erskine, Guilford
Leaming	W. A. Lanterman, Fairfield
Herr's White Cap	W. F. Herr, Brooklyn

SILAGE.

Beardsley's Leaming	H. Beardsley, Roxbury
Hazenhurst White Cap	E. Hazen, Haddam
Brewer's Dent	N. H. Brewer, Hockanum
Webber's Dent	Willis Frost, Bridgewater
Northern White Dent	B. W. Bishop, Guilford
Luce's Favorite	Suffolk Co-op. Assoc., Mattituck, L. I.
Leaming	F. S. Prince, Xenia, Ohio
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill.

District V.

GRAIN.

Flints.

Burwell's Yellow Flint	E. E. Burwell, New Haven
Longfellow	R. Keeler, Bridgewater
Longfellow	P. J. Behan, Roxbury
Sanford White Flint	Jesse St. John, Kent
Frost's Yellow Flint	Charles Frost, Sherman
Gold Nugget	Mary Bacon, Kent
Gold Nugget	A. L. Purdy, Port Chester, N. Y.
U. S. Dept. Agriculture No. 193	Bureau Plant Industry, Washington, D. C.

Dents.

Century	S. M. Waldron, New Milford
Lakeside Dent	N. Jones, So. Windsor
Beardsley's Leaming	H. Beardsley, Roxbury
Webber's Dent	Willis Frost, Bridgewater
Early Michigan	G. A. Erskine, Guilford
Herr's White Cap	W. F. Herr, Brooklyn
Brewer's Dent	N. H. Brewer, Hockanum
Lanterman's Leaming	W. A. Lanterman, Fairfield
Northern White Dent	B. W. Bishop, Guilford
Luce's Favorite	Suffolk Co-op. Assoc., Mattituck, L. I.
Sutton's Dent	R. C. Wilcox Sons, Guilford
Vinehill Leaming	Vinehill Farm, Elmwood

SILAGE.

Northern White Dent	B. W. Bishop, Guilford
Leaming	S. F. Prince, Xenia, Ohio
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill.
Early Mastodon	E. G. Packard, Dover, Del.
Eureka	Ross Bros. Seed Co., Worcester, Mass.

Changing Seed.

Some of the high yielding varieties as shown in these tests, are now no longer grown by the farmers from whom they were secured. In a few cases these varieties cannot be located anywhere and it is probable that they have been lost. From this it is seen that the practice of changing seed is quite common in Connecticut. These tests show clearly that it is not necessary to secure new varieties from another part of the state or from without to maintain high yields. Many of the very best varieties have been grown continuously on the same farm for as long as there is any record and there is no reason why they should not go on giving satisfaction.

The more than one hundred and fifty varieties and strains of corn grown in Connecticut is in marked contrast to the central corn growing districts where a single variety is grown almost exclusively over wide areas. New varieties should not replace well established varieties until their superiority has been demonstrated on the farm where the corn is to be grown.

Summary.

Nearly 150 different varieties and strains of flint and dent corn have been grown at Mt. Carmel and at Storrs to compare their yield of grain and time of ripening. These varieties are described and a history of their origin is given as far as known.

Certain varieties have yielded among the highest at both places. These are listed on pages 401, 402 and 404.

Dent varieties on the average require a longer growing season than flints and yield more grain and stover.

When dent and flint varieties maturing in the same length of time are compared the dents on the average yield 7.9 per cent. more at Storrs and 10.5 per cent. more at Mt. Carmel than the flints showing that they are somewhat more efficient as producers of grain, but the dents do not always ripen as satisfactorily as the flints.

In some seasons the highest yielding flint varieties surpass the highest yielding dent varieties at both places tested.

There is no difference in the yield of yellow and white dent varieties or of flint varieties.

The state is divided into five districts, and dent, flint and silage varieties recommended for trial in each district are listed on pages 409 to 411.

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TABLE I. FLINT VARIETIES GROWN AT MT. CARMEL.

Variety	Source of seed.	No. years tested.	Color.	Maturity.	Actual yield, bu. per acre.	Relative yield, per cent.
Argentine Flint	S. D. LaBarr, Greenwich	2	Yellow	Medium	66.1	90.4
Averill's Yellow Flint	Albert Averill, Pomfret Landing	1	Yellow	Medium	56.5	81.2
Avery's White Flint	B. T. Avery, Ledyard	3	White	Medium	65.5	94.6
Beebe's Yellow Flint	C. M. Beebe, Uncasville	1	Yellow	Early	65.5	82.2
Borger's Yellow Flint	C. E. Borger, New Preston	4	Yellow	Early	46.6	80.1
Brewer's Flint	N. H. Brewer, Hockanum	1	Yellow	Medium	59.0	84.8
Burwell's Flint	E. E. Burwell, New Haven	8	Yellow	Medium	61.4	100.0
Canada Yellow Flint	Thomas Griswold & Sons, South Wethersfield	3	Yellow	Medium	63.5	89.1
Canada Yellow Flint	Jason Lathrop, Plainfield	6	Yellow	Medium	50.8	76.6
Canada Yellow Flint	L. S. Abbe, Hazardville	1	Yellow	Early	45.4	73.9
Chace's Yellow Flint	M. W. Chace, Pomfret Landing	4	Yellow	Medium	62.3	88.3
Connecticut Yellow Flint	O. S. Olmsted, Hazardville	3	Yellow	Early	59.0	84.8
Crowell's Prolific	David Crowell, Middletown	1	Yellow	Late	58.0	83.3
Davis' Yellow Flint	P. E. Davis, Granby, Mass.	3	Yellow	Early	64.6	90.1
Double Capped White Flint	W. A. Thrall, Windsor	1	White	Medium	44.2	93.1
Fairview Flint	Harrison Hamilton, Ellington	3	Yellow	Early	55.3	79.6
Fenn's 12 Row	R. M. Fenn, Middlebury	4	Yellow	Medium	48.0	92.8
Frost's Yellow Flint	Charles Frost, Sherman	5	Yellow	Medium	66.3	120.4
Gold Nugget	Mary Bacon, Kent	6	Yellow	Medium	73.1	116.5
Gold Nugget	A. L. Purdy, Port Chester, New York	4	Yellow	Medium	55.6	106.7
Gold Nugget	J. B. Stratton, Watertown	2	Yellow	Medium	60.6	113.1
Griswold's 90 Day	Thomas Griswold & Sons, South Wethersfield	3	Yellow	Early	50.3	68.0
Hauschild's Yellow Flint	Julius Hauschild, Storrs	1	Yellow	Early	68.1	85.4
Ibsen's Yellow Flint	J. C. Ibsen, North Haven	3	Yellow	Medium	54.5	100.5
King Philip	W. E. Price, Warehouse Point	7	Red	Medium	54.3	84.6
Longfellow	John Basham, Middlebury	4	Yellow	Early	49.0	83.8
Longfellow	P. J. Behan, Roxbury	5	Yellow	Medium	56.1	100.0
Longfellow	N. G. Gelston, Sherman	4	Yellow	Early	63.9	93.2
Longfellow	Reuben Keeler, Bridgewater	4	Yellow	Medium	59.9	101.9
Longfellow	N. R. Mosher, Sherman	3	Yellow	Early	67.6	95.3
Mammoth White Flint	O. S. Olmsted, Hazardville	4	White	Late	83.4	118.6
Mammoth Yellow Flint	Louis Rosensweig, South Canterbury	1	Yellow	Late	71.4	102.6
McLean's Flint	J. B. McLean, Simsbury	3	Yellow	Early	50.7	94.4
Montgomery's White Flint	Phelps Montgomery, Mt. Carmel	1	White	Medium	55.6	84.1
Pied Flint	Reuben Keeler, Bridgewater	3	Yellow and White	Medium	73.0	102.7
Red Flint	Benj. Neleber, Colchester	2	Red	Medium	62.1	85.2
Red Flint	Albert Hale, South Glastonbury	1	Red	Medium	63.2	90.8
Red Flint	S. F. Brown, Windsor	4	Red	Early	61.0	86.5
Rhode Island Premium	W. J. Clark, Woodbury	3	Red	Early	54.5	77.3
Rhode Island White Flint	E. P. Barnes, Norwich	2	White	Medium	75.9	104.4
Rhode Island White Flint	A. C. Botham, Pomfret	2	White	Early	62.2	84.8
Rhode Island White Flint	W. P. Briggs, Lebanon	3	White	Early	57.6	81.3
Rhode Island White Flint	F. W. Newton, South Canterbury	2	White	Medium	55.3	81.5
Rhode Island White Flint	Rhode Island Experiment Station, Kingston, R. I.	6	White	Medium	60.9	93.7
Rhode Island White Flint	A. A. Young, Jewett City	2	White	Medium	72.0	98.7
Root's Yellow Flint	L. C. Root, Farmington	1	Yellow	Medium	39.4	82.9
Sanford White Flint	C. E. Hough, Washington	1	White	Medium	40.6	85.5
Sanford White Flint	Jesse St. John, Kent	7	White	Medium	64.0	106.6
Schultz's White Flint	W. F. Schultz, Saybrook	1	White	Medium	36.6	77.0
Sheffield Yellow Flint	C. H. Sage, East Canaan	4	Yellow	Early	56.9	82.9
Skilton's Yellow Flint	Julius Skilton, Watertown	6	Yellow	Medium	61.8	98.6
Smut Nose Flint	G. A. Skilton, Watertown	3	White	Medium	56.1	93.8
Smut Nose Flint	Robert Skilton, Morris	4	White	Early	54.7	79.4
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	2	Yellow	Medium	61.9	85.0
Stickney's Yellow Flint	L. J. Grant, Wapping	2	Yellow	Medium	52.1	103.4
Taylor's Yellow Flint	G. E. Taylor, Shelburne, Mass.	3	Yellow	Medium	61.9	86.2
Tucker's Yellow Flint	F. E. Tucker, Vernon	2	Yellow	Medium	60.7	84.8
U. S. Dept. of Agric. No. 193	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Medium	51.8	106.9
Wheaton's 12 Row	E. M. Wheaton, Putnam	3	Yellow	Medium	43.5	89.3
Yellow Dutton	C. H. Bissell, Lakeville	5	Yellow	Early	65.0	100.3
Yellow Dutton	H. Johnson, Washington	1	Yellow	Medium	42.6	89.7
Zwick's Yellow Flint	Louis Zwick, Plantsville	5	Yellow	Medium	66.6	96.7

TABLE II DENT VARIETIES GROWN AT MT. CARMEL.

Variety.	Sources of seed.	No. years tested.	Color.	Maturity.	Actual yield, bu. per acre.	Relative yield, per cent.
Bahler's White Dent	Adolph Bahler, Ellington	4	White	Medium	55.8	97.3
Brewer's Dent	N. H. Brewer, Hockanum	7	Yellow	Late	73.7	114.5
Brewer's Dent	B. F. Page, Durham	1	Yellow	Late	64.3	104.7
Century Dent	S. M. Waldron, New Milford	7	Yellow	Medium	69.8	118.0
Clark's Early Wonder	Harris Seed Co., Coldwater, New York	1	Yellow	Medium	76.4	115.6
Connecticut Dent	C. L. Howes, Stamford	4	Yellow	Late	80.6	113.9
Cornell No. 11	Dept. of Plant Breeding, Cornell Univ., Ithaca, New York	3	Yellow	Medium	56.6	115.3
Cornell No. 12	Dept. of Plant Breeding, Cornell Univ., Ithaca, New York	3	Yellow	Medium	54.3	110.6
Dibble's Dent	Dibble Seed Co., Honeoye Falls, New York	2	Yellow	Medium	83.8	114.2
Dowd Dent	R. C. Wilcox Sons, Guilford	4	Yellow	Medium	82.9	119.6
Eureka	Ross Bros. Seed Co., Worcester, Mass.	1	White	Very late	36.3	52.2
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill	3	Yellow	Very late	82.2	114.5
Gelston's Ensilage	W. I. Gelston, East Haddam	1	Yellow	Very late	58.1	83.5
Golden Dent	P. H. Woodford, Avon	6	Yellow	Late	71.6	107.5
Golden Dent	Alex. Smith, Clintonville	2	Yellow	Early	61.6	94.5
Hastings' Yellow Dent	W. S. Hastings, Somers	2	Yellow	Early	39.8	76.0
Hazenhurst White Cap	E. Hazen, Haddam	3	Yellow	Late	53.9	109.2
Herr's Yellow Dent	W. F. Herr, Brooklyn	2	Yellow	Late	61.7	123.6
Hickory King	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	53.2	98.4
Holcomb's Dent	R. Holcomb, East Granby	1	Yellow	Medium	66.3	100.3
Early Huron	Harris Seed Co., Coldwater, New York	3	Yellow	Medium	76.1	106.2
Early Huron	M. H. Williams, Sunderland, Mass.	3	Yellow	Medium	79.6	110.6
Johnson's Yellow Dent	J. W. Moss, West Cheshire	3	Yellow	Late	52.6	106.6
Klondyke	George Hale, Westport	4	Yellow	Late	88.1	128.0
Lakeside Dent	N. Jones, South Windsor	8	Yellow	Late	69.1	112.4
Lakeside Dent	S. H. Peckham, Woodstock	1	Yellow	Medium	39.3	82.7
Lancaster Sure Crop	Lancaster County, Penna.	1	Yellow	Very late	60.3	131.7
Leaming	H. Beardsley, Roxbury	7	Yellow	Medium	74.9	122.1
Leaming	L. P. Drake, Harwinton	2	Yellow	Medium	76.5	104.8
Leaming	*H. Hamilton, Ellington*	4	Yellow	Medium	64.2	111.1
Leaming	W. A. Lanterman, Fairfield	3	Yellow	Late	60.4	122.4
Leaming	F. S. Prince, Xenia, Ohio	2	Yellow	Late	57.0	111.7
Leaming	N. S. Strong, North Plain	1	Yellow	Medium	50.7	106.7
Leaming	W. H. Strong, Avon	1	Yellow	Early	79.6	117.6
Leaming	Vinehill Farm, Elmwood	4	Yellow	Medium	60.1	116.4
Long Island Dent	C. E. Salmon, Brooklyn	1	Yellow	Medium	15.4	32.4
Long's Champion Dent	Whitehorse Farms, Paoli, Penna.	1	Yellow	Very late	110.6	138.8
Luce's Favorite	Suffolk Co-operative Assoc., Mattituck, N. Y.	4	Yellow	Late	61.9	117.5
Mason's White Dent	W. W. Chappell, North Franklin	4	White	Medium	62.9	91.2
Early Michigan	G. A. Erskine, Guilford	3	Yellow	Late	65.3	120.1
Early Michigan	H. J. Larkham, Norwichtown	1	Yellow	Medium	46.6	98.1
Minnesota White Cap	C. S. Griswold, West Hartford	4	Yellow	Late	81.7	115.1
Minnesota No. 13	W. A. Stocking & Sons, Weatogue	3	Yellow	Early	44.4	75.7
Montgomery's White Dent	Phelps Montgomery, Mr. Carmel	1	White	Medium	88.2	133.4
Northern White Dent	B. W. Bishop, Guilford	5	White	Late	77.0	121.9
Peck's Yellow Dent	W. O. Peck, East Haddam	2	Yellow	Late	62.3	122.0
Pride of the North	A. G. Gulley, Storrs	6	Yellow	Medium	58.6	92.4
Pride of the North	I. N. Hollister, Glastonbury	1	Yellow	Very late	57.7	82.9
Pride of the North	L. W. Kirk, Hamden	1	Yellow	Late	46.7	98.3
Red Cob	F. S. Platt Seed Co., New Haven	1	Yellow	Very late	59.7	85.8
Reynolds' Dent	W. W. Reynolds, New Britain	1	Yellow	Late	32.8	69.0
Sciota	B. F. Page, Durham	2	Yellow	Early	65.2	100.9
Sharon White Cap	E. K. Dean, Sharon	6	Yellow	Medium	64.8	102.3
Silver King	Roy McDonald, Menomonie, Wisconsin	3	White	Medium	57.2	116.8
Sutton's Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	63.6	117.0
Sweepstakes	S. L. Hollister, Washington	1	Yellow	Late	38.5	81.0
Sweepstakes	Alex. Smith & Sons, Clintonville	1	Yellow	Late	36.9	77.7
Tryon Dent	J. E. Daniels, Middletown	3	Yellow	Medium	81.8	113.7
U. S. Dept. of Agric. No. 133	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Medium	44.8	91.2
U. S. Dept. of Agric. No. 125	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	2	Yellow	Very late	65.3	131.1
U. S. Dept. of Agric. No. 119	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	2	White	Very late	54.9	110.8
Webber's Dent	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	3	Yellow	Medium	46.3	93.9
Webber's Dent	Willis Frost, Bridgewater	6	Yellow	Medium	72.2	120.5
White Cap	G. D. Hall, Wallingford	5	Yellow	Medium	64.5	93.0
White Cap	W. F. Herr, Brooklyn	3	Yellow	Medium	63.7	129.4
White Cap	L. C. Root & Son, Farmington	2	Yellow	Late	62.9	126.1
White Cap	Henry Squires, New Milford	1	Yellow	Medium	73.1	110.6
White Cap	N. S. Strong, North Plain	2	White	Early	47.0	80.2
White Cap	Joseph Whathley, Kent	1	Yellow	Medium	46.8	76.2
Woodford's Dent	G. C. Woodford, Plainville	2	Yellow	Medium	53.5	99.9

TABLE III SILAGE VARIETIES GROWN AT MT. CARMEL.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Per cent. dry matter.	Actual green matter tons per acre.	Relative green matter per cent.	Actual dry matter tons per acre.	Relative dry matter per cent.
Bahler's White Dent	Adolph Bahler, Ellington	3	White	Medium	35.4	9.9	41.6	3.1	50.3
Brewer's Dent	N. H. Brewer, Hockanum	7	Yellow	Late	32.9	14.8	63.1	4.6	74.5
Brewer's Dent	B. F. Page, Durham	1	Yellow	Late	39.3	9.1	40.4	3.6	54.9
Century Dent	S. M. Waldron, New Milford	5	Yellow	Medium	31.6	13.4	54.6	3.7	60.1
Connecticut Dent	C. L. Howes, Stamford	4	Yellow	Medium	26.6	15.9	62.3	4.2	65.9
Curtain's Yellow Dent	E. Curtain, East Windsor	1	Yellow	Medium	25.2	14.1	60.2	3.6	63.4
Dibble's Yellow Dent	Dibble Seed Co., Honeoye Falls, New York	2	Yellow	Early	25.4	15.8	62.0	3.9	62.8
Dowd Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	29.4	14.9	55.0	4.1	59.0
Eureka	Ross Bros. Seed Co., Worcester, Mass.	8	White	Very late	26.6	22.4	100.0	5.9	100.0
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill.	3	Yellow	Late	29.3	15.4	63.8	4.5	75.1
Gelston's Ensilage	W. I. Gelston, East Haddam	4	Yellow	Medium	27.5	17.1	67.2	4.7	74.3
Golden Dent	Alex Smith, Clintonville	1	Yellow	Medium	45.8	5.6	24.9	2.5	39.2
Golden Dent	P. H. Woodford, Avon	6	Yellow	Medium	29.7	14.7	60.8	4.1	65.9
Gold Nugget Flint	Mary Bacon, Kent	4	Yellow	Medium	29.9	14.4	55.6	4.3	63.2
Hazenhurst White Cap	E. Hazen, Haddam	1	Yellow	Medium	29.5	15.7	81.7	4.6	91.6
Klondyke	George Hale, Westport	4	Yellow	Late	31.8	17.7	68.3	5.2	78.6
Lakeside Dent	N. Jones, South Windsor	4	Yellow	Medium	36.3	14.2	67.3	5.1	84.4
Leaming	H. Beardsley, Roxbury	6	Yellow	Medium	32.1	14.8	63.4	4.5	72.9
Leaming	L. P. Drake, Harwinton	1	Yellow	Early	24.2	13.4	48.4	3.2	49.9
Leaming	H. Hamilton, Ellington	2	Yellow	Medium	36.9	9.5	46.5	3.5	61.0
Leaming	E. Harris, Middletown	1	Yellow	Early	22.2	15.6	66.7	3.5	61.9
Leaming	W. A. Lanterman, Fairfield	1	Yellow	Late	33.3	15.6	81.5	5.2	103.4
Leaming	F. S. Prince, Xenia, Ohio	2	Yellow	Very late	32.1	12.0	68.5	3.9	85.7
Leaming	W. H. Strong, Avon	3	Yellow	Early	28.0	15.5	61.6	4.3	67.5
Leaming	Vinehill Farm, Elmwood	2	Yellow	Medium	36.4	9.6	47.1	3.4	65.9
Longfellow Flint	Platt Seed Co., New Haven	1	Yellow	Early	23.6	17.0	72.6	4.0	71.4
Luce's Favorite	Suffolk Co-operative Association, Mattituck, N. Y.	3	Yellow	Medium	35.1	13.6	69.4	4.7	82.0
Mammoth White Flint	O. S. Olmsted, Hazardville	4	White	Medium	27.4	16.6	64.8	4.7	69.5
Mammoth Yellow Flint	Louis Rosensweig, South Canterbury	1	Yellow	Medium	25.1	17.4	74.3	4.4	77.8
Mason's White Dent	W. W. Chappell, North Franklin	2	White	Early	24.4	13.7	43.2	3.3	46.6
Mastodon	Platt Seed Co., New Haven	2	Yellow	Very late	27.7	21.9	77.4	6.0	85.4
Mastodon	E. G. Packard, Dover, Delaware	6	Yellow	Very late	29.1	17.2	84.3	4.9	90.0
Minnesota No. 13	W. A. Stocking, Weatogue	2	Yellow	Medium	38.6	10.4	40.1	3.9	54.9
Northern White Dent	B. W. Bishop, Guilford	5	White	Late	33.4	15.8	68.4	5.0	79.7
Pride of the North	A. G. Gulley, Storrs	1	Yellow	Early	26.2	16.9	66.7	4.0	66.6
Pride of the North	I. W. Hollister, Glastonbury	1	Yellow	Medium	27.5	13.2	56.4	3.6	64.7
Red Cob	Platt Seed Co., New Haven	1	White	Very late	27.9	17.0	72.6	4.7	84.4
Sanford White Flint	Jesse St. John, Kent	2	White	Early	28.4	13.7	52.2	3.8	53.2
Silver King	Roy McDonald, Menomonie, Wisconsin	2	White	Medium	40.7	10.6	56.9	4.2	78.2
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	2	Yellow	Early	24.2	12.4	48.0	3.5	47.4
Sutton's Yellow Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	38.7	10.4	52.8	4.0	70.1
Sweepstakes	Clark Seed Co., Milford	2	Yellow	Late	32.2	11.9	66.3	3.9	83.7
Tryon Dent	J. E. Daniels, Middletown	1	Yellow	Early	24.6	15.2	64.9	3.7	66.6
Webber's Dent	Willis Frost, Bridgewater	5	Yellow	Medium	36.6	12.2	58.9	4.3	76.0
White Cap	C. S. Griswold, West Hartford	4	Yellow	Early	27.4	17.5	67.8	4.7	73.7
White Cap	G. D. Hall, Wallingford	2	Yellow	Early	27.0	14.7	57.7	3.9	62.9

TABLE IV FLINT VARIETIES GROWN AT STORRS.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Yield of stover pounds per acre.	Relative yield of stover per cent.	Yield of grain bushel per acre.	Relative yield of grain per cent.	Relative dry matter in ear corn per cent.	Relative per cent. soft corn per cent.
Argentine Flint	S. D. LaBarr, Greenwich	2	Yellow	Medium	3,096	56	51.1	82	101	82
Averill's Yellow Flint	Albert Averill, Pomfret Landing	2	Yellow	Early	3,845	74	60.9	89	104	119
Avery's White Flint	B. T. Avery, Ledyard	3	White	Medium	4,524	87	42.7	77	99	54
Barnes' White Flint	F. A. Barnes, Preston City	1	White	Medium	8,059	108	61.5	89	....	95
Beebe's Yellow Flint	C. M. Beebe, Uncasville	1	Yellow	Early	6,119	82	61.5	89	....	6
Brewer's Flint	N. H. Brewer, Hockanum	2	Yellow	Early	3,662	73	57.7	84	104	94
Burwell's Flint	E. E. Burwell, New Haven	9	Yellow	Medium	4,780	100	58.3	100	100	100
Canada Yellow Flint	Thomas Griswold & Sons, So. Wethersfield	3	Yellow	Medium	5,584	97	62.8	98	97	83
Canada Yellow Flint	Jason Lathrop, Plainfield	8	Yellow	Early	3,187	63	51.4	84	106	126
Canada Yellow Flint	L. S. Abbe, Hazardville	2	Yellow	Early	2,036	49	35.6	74	102	9
Chace's Yellow Flint	M. W. Chace, Pomfret Landing	4	Yellow	Early	4,705	81	58.0	93	98	71
Connecticut Yellow Flint	O. S. Olmsted, Hazardville	3	Yellow	Early	3,190	62	45.6	86	102	145
Crowell's Prolific	David Crowell, Middletown	1	Yellow	Late	6,920	120	58.8	89	89	148
Davis Yellow Flint	P. E. Davis, Granby, Mass	4	Yellow	Early	3,757	69	60.7	92	104	104
Double Capped White Flint	W. A. Thrall, Windsor	2	White	Early	3,015	58	46.4	73	102	0
Fairview Flint	Harrison Hamilton, Ellington	4	Yellow	Early	2,902	53	43.9	77	111	30
Fenn's 12 Row	R. M. Fenn, Middlebury	3	Yellow	Medium	4,171	94	46.0	81	97	384
Frost's Yellow Flint	Charles Frost, Sherman	4	Yellow	Medium	5,003	111	59.8	106	102	132
Gold Nugget	Mary Bacon, Kent	7	Yellow	Medium	5,198	119	59.2	109	94	619
Gold Nugget	A. L. Purdy, Port Chester, New York	3	Yellow	Medium	5,256	116	54.4	95	93	411
Gold Nugget	J. B. Stratton, Watertown	2	Yellow	Medium	5,954	137	46.6	95	90	282
Griswold's 90 Day	Thomas Griswold & Sons, So. Wethersfield	3	Yellow	Early	3,981	71	52.1	82	106	65
Hathaway's Yellow Flint	Auburn, Maine	1	Yellow	Early	1,065	23	30.3	42	....	123
Hauschild's Yellow Flint	Julius Hauschild, Storrs	4	Yellow	Early	4,751	87	62.5	96	98	88
Hayes' Canada Flint	M. C. Hayes, Granby	1	Yellow	Medium	3,533	75	64.7	90	....	123
Healey's Yellow Flint	L. H. Healey, Woodstock	3	Yellow	Early	2,679	64	51.6	96	104	85
Ibsen's Yellow Flint	J. C. Ibsen, North Haven	3	Yellow	Medium	5,436	121	50.4	88	94	374
King Philip	W. E. Price, Warehouse Point	8	Red	Early	4,489	88	53.4	87	97	75
Longfellow	John Basham, Middlebury	3	Yellow	Medium	3,716	88	43.1	82	100	240
Longfellow	P. J. Behan, Roxbury	5	Yellow	Medium	4,191	108	53.2	101	97	278
Longfellow	N. G. Gelston, Sherman	4	Yellow	Medium	4,830	101	51.2	91	98	117
Longfellow	Reuben Keeler, Bridgewater	4	Yellow	Medium	4,610	103	54.8	97	97	261

Longfellow	N. R. Mosher, Sherman	3	Yellow	Medium	4,503	78	59.3	97	105	219
Longfellow	F. S. Platt Seed Co., New Haven	1	Yellow	Medium	5,675	99	67.1	102	97	87
Longfellow	C. H. Savage, Storrs	1	Yellow	Medium	2,952	63	57.7	81	....	150
Mammoth White Flint	O. S. Olmsted, Hazardville	5	White	Medium	6,976	128	64.5	102	94	78
Mammoth Yellow Flint	Louis Rosensweig, So. Canterbury	1	Yellow	Medium	7,507	131	77.5	118	95	119
McLean's Flint	J. B. McLean, Simsbury	3	Yellow	Early	3,173	72	45.3	80	99	231
Montgomery's White Flint	Phelps Montgomery, Mt. Carmel	1	White	Medium	4,937	105	57.2	80	....	136
Pied Flint	Reuben Keeler, Bridgewater	3	Yellow and White	Medium	5,539	99	57.8	95	96	646
Red Flint	Benj. Neleber, Colchester	3	Red	Medium	5,128	96	66.1	100	101	62
Red Flint	Albert Hale, So. Glastonbury	1	Red	Early	4,211	73	58.9	90	99	96
Red Flint	S. F. Brown, Windsor	6	Red	Early	3,545	70	54.5	90	99	120
Red Glaze	J. H. Wilson, Baltic	1	Smut nosed White	Early	7,207	97	61.6	89	....	80
Rhode Island Premium	W. J. Clark, Woodbury	3	Red	Early	2,923	52	52.8	87	112	47
Rhode Island White Flint	E. P. Barnes, Norwich	2	White	Early	7,174	96	58.9	93	93	1,182
Rhode Island White Flint	A. C. Botham, Pomfret	3	White	Early	3,821	66	56.0	91	106	33
Rhode Island White Flint	W. P. Briggs, Lebanon	3	White	Early	3,767	67	56.3	92	106	19
Rhode Island White Flint	F. W. Newton, So. Canterbury	1	White	Early	4,373	76	54.0	82	98	106
Rhode Island White Flint	Rhode Island Exp. Station, Kingston, R. I.	9	White	Early	3,938	83	54.9	95	103	34
Rhode Island White Flint	A. A. Young, Jewett City	2	White	Early	6,435	87	59.4	94	101	26
Root's Yellow Flint	L. C. Root, Farmington	1	Yellow	Medium	3,022	55	48.0	80	103	71
Rosebrooks' Flint	Charles Rosebrooks, Storrs	2	Yellow	Early	2,632	50	52.0	76	103	150
Sanford White Flint	C. E. Hough, Washington	1	White	Medium	5,365	98	61.0	102	94	93
Sanford White Flint	Jesse St. John, Kent	7	White	Medium	4,731	105	59.4	108	100	150
Schultz's White Flint	W. F. Schultz, Saybrook	1	White	Medium	5,378	99	55.2	92	96	33
Sheffield Yellow Flint	Farm Dept., Conn. Agricultural College, Storrs	2	Yellow	Early	3,428	65	63.9	93	100	147
Sheffield Yellow Flint	C. H. Sage, East Canaan	4	Yellow	Early	2,569	54	45.5	83	109	18
Sheffield Yellow Flint	C. E. Borger, New Preston	4	Yellow	Early	2,782	62	50.2	90	105	31
Silver Triumph	C. J. Anderson, New Preston	1	White	Late	6,269	128	84.5	122	96	236
Skilton's Yellow Flint	Julius Skilton, Watertown	6	Yellow	Medium	5,354	107	59.8	102	97	177
Smut Nose Flint	G. A. Skilton, Watertown	3	White	Medium	3,400	80	46.7	89	99	100
Smut Nose Flint	Robert Skilton, Morris	4	White	Early	3,601	73	48.7	88	102	34
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	3	Yellow	Medium	4,807	87	59.2	89	99	108
Stickney's Yellow Flint	L. J. Grant, Wapping	3	Yellow	Medium	4,314	105	54.4	98	99	172
Taylor's Yellow Flint	G. E. Taylor, Shelburne, Mass	4	Yellow	Early	3,765	68	58.8	89	105	80
Tucker's Yellow Flint	F. E. Tucker, Vernon	3	Yellow	Early	3,320	62	56.3	86	106	112
U. S. Dept. of Agric. No. 193	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Late	6,000	154	59.2	113	89	1,687
Wheaton's 12 Row	E. M. Wheaton, Putnam	2	Yellow	Medium	3,893	75	54.1	84	99	0
Yellow Dutton	C. H. Bissell, Lakeville	5	Yellow	Early	3,290	66	52.9	93	103	523
Yellow Dutton	H. Johnson, Washington	1	Yellow	Early	3,584	66	48.1	81	101	38
Zwick's Yellow Flint	Louis Zwick, Plantsville	6	Yellow	Medium	4,919	98	56.7	94	99	167

TABLE V DENT VARIETIES GROWN AT STORRS.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Yield of stover pounds per acre.	Relative yield of stover per cent.	Yield of grain bushel per acre.	Relative yield of grain per cent.	Relative dry matter in ear corn per cent.	Relative per cent. soft corn per cent.
Bahler's White Dent	Adolph Bahler, Ellington	4	White	Medium	4,922	106	58.5	106	96	702
Brewer's Dent	N. H. Brewer, Hockanum	8	Yellow	Late	7,233	146	58.8	97	86	1,101
Brewer's Dent	B. F. Page, Durham	1	Yellow	Late	5,751	171	42.6	112	82	1,369
Century Dent	S. M. Waldron, New Milford	7	Yellow	Medium	4,535	103	62.4	116	94	319
Connecticut Dent	C. L. Howes, Stamford	5	Yellow	Late	6,587	122	63.0	98	91	987
Cornell No. 11	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	3	Yellow	Early	3,595	91	57.0	102	97	108
Cornell No. 12	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	3	Yellow	Medium	4,351	107	53.8	96	97	118
Dibble's Dent	Dibble Seed Co., Honeoye Falls, New York	3	Yellow	Late	7,642	144	63.4	96	88	87
Dowd Dent	R. C. Wilcox Sons, Guilford	5	Yellow	Medium	6,217	131	64.8	112	86	2,153
Eureka	Ross Bros. Seed, Co. Worcester, Mass.	2	White	Very late	19,077	371	44.4	66	67	928
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill	2	Yellow	Late	8,579	165	57.4	80	...	120
Golden Dent	P. H. Woodford, Avon	7	Yellow	Medium	5,801	119	61.9	102	85	1,295
Golden Dent	Alex Smith, Clintonville	1	Yellow	Late	5,225	121	43.2	113	88	1,288
Hastings' Yellow Dent	W. S. Hastings, Somers	2	Yellow	Very early	2,603	62	38.6	85	105	287
Hazenhurst White Cap	E. Hazen, Haddam	2	Yellow	Late	7,884	153	78.6	120	90	94
Herr's Yellow Dent	W. F. Herr, Brooklyn	2	Yellow	Medium	3,683	108	67.6	128	94	82
Hickory King	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	5,141	116	61.2	111	91	614
Early Huron	Harris Seed Co., Coldwater, New York	4	Yellow	Medium	4,503	78	63.0	96	97	138
Early Huron	M. H. Williams, Sunderland, Mass	3	Yellow	Medium	4,682	82	67.6	106	94	60
Johnson's Yellow Dent	J. W. Moss, West Cheshire	3	Yellow	Late	7,226	184	62.7	110	85	1,271
Klondyke	George Hale, Westport	3	Yellow	Late	11,082	196	59.5	98	81	3,748
Lakeside Dent	N. Jones, South Windsor	8	Yellow	Late	6,301	141	60.9	108	92	401
Lakeside Dent	S. H. Peckham, Woodstock	2	Yellow	Medium	4,789	120	47.6	101	96	243
Leaming	H. Beardsley, Roxbury	7	Yellow	Medium	6,553	151	61.7	112	90	927
Leaming	L. P. Drake, Harwinton	1	Yellow	Medium	2,562	61	49.0	86	100	86
Leaming	H. Hamilton, Ellington	3	Yellow	Medium	5,338	123	58.4	108	93	561
Leaming	W. A. Lanterman, Fairfield	3	Yellow	Medium	7,450	170	66.6	119	90	538
Leaming	Feed Store, Norwich	1	Yellow	Very late	6,114	112	13.6	23	77	707
Leaming	F. S. Prince, Xenia, Ohio	3	Yellow	Late	6,553	167	62.5	112	87	458
Leaming	W. H. Strong, Avon	3	Yellow	Medium	5,046	90	56.8	93	96	1,479

Leaming	Vinehill Farm, Elmwood	3	Yellow	Medium	5,077	117	65.0	119	95	335
Leaming	W. J. Wells, South Deerfield	1	Yellow	Medium	3,973	118	46.8	123	90	600
Long Island Dent	C. E. Salmon, Brooklyn	2	Yellow	Early	3,779	91	32.4	71	98	100
Long's Champion Dent	Whitehorse Farms, Paoli, Pa.	1	Yellow	Very late	17,013	229	.....	...	....	852
Luce's Favorite	Suffolk Co-operative Assoc., Mattituck, N. Y.	3	Yellow	Late	8,197	187	63.3	113	84	712
Mason's White Dent	W. W. Chappell, North Franklin	4	White	Medium	3,705	79	54.5	100	100	142
Mastodon	E. G. Packard, Dover, Del	2	Yellow	Very late	15,926	309	67.5	102	75	510
Early Michigan	G. A. Erskine, Guilford	3	Yellow	Medium	5,652	129	65.1	119	90	328
Minnesota White Cap	C. S. Griswold, West Hartford	4	Yellow	Medium	6,532	117	65.9	106	91	520
Minnesota No. 13	W. A. Stocking & Sons, Weatogue	3	Yellow	Early	2,834	70	43.1	89	105	504
New Hampshire No. 500	New Hampshire Experiment Station, Durham, N. H.	2	Yellow	Very early	1,920	43	46.2	72	106	247
Northern White Dent	B. W. Bishop, Guilford	5	White	Very late	8,413	171	61.4	109	77	4,978
Peck's Yellow Dent	W. O. Peck, East Haddam	3	Yellow	Medium	4,697	117	67.6	123	97	264
Pride of the North	Connecticut Agricultural College, Storrs	9	Yellow	Medium	5,346	114	59.7	104	95	554
Pride of the North	I. N. Hollister, Glastonbury	1	Yellow	Medium	5,293	92	49.7	76	92	92
Pride of the North	L. W. Kirk, Hamden	1	Yellow	Medium	5,766	106	44.4	74	97	88
Pride of the North	H. J. Larkham, Norwichtown	1	Yellow	Medium	4,304	79	48.3	81	100	27
Reynolds' Dent	W. W. Reynolds, New Britain	1	Yellow	Late	5,260	96	45.2	76	93	91
Sciota	B. F. Page, Durham	2	Yellow	Medium	3,727	111	52.0	111	103	631
Sharon White Cap	E. K. Dean, Sharon	7	Yellow	Medium	4,072	93	59.9	110	99	245
Silver King	Roy McDonald, Menomonie, Wisconsin	3	White	Medium	4,460	112	60.6	112	96	193
Sutton's Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	6,354	145	61.8	111	88	1,126
Sweepstakes	S. L. Hollister, Washington	1	Yellow	Late	7,793	143	46.4	78	85	246
Sweepstakes	Alex. Smith, Clintonville	1	Yellow	Late	6,064	111	50.2	84	84	203
Sweepstakes	West Branch Seed Growers' Assn., Williamsport, Pa.	2	Yellow	Late	6,361	175	84.4	155	90	222
Tryon Dent	J. E. Daniels, Middletown	3	Yellow	Medium	5,248	92	69.8	109	96	37
U.S. Dept. of Agric. No. 119	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	2	White	Very late	13,821	269	54.2	82	75	749
U.S. Dept. of Agric. No. 125	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	1	Yellow	Late	7,955	162	98.3	142	89	56
U.S. Dept. of Agric. No. 133	Office of Cereal Invsetigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Medium	3,292	83	51.8	97	98	114
Webber's Dent	Dept. of Plant Breeding, Cornell Univ., Ithaca, N.Y.	2	Yellow	Early	3,696	72	59.3	92	103	220
Webber's Dent	Willis Frost, Bridgewater	6	Yellow	Medium	6,086	141	61.9	114	78	795
White Cap	G. D. Hall, Wallingford	6	Yellow	Medium	3,486	69	51.9	88	97	479
White Cap	W. F. Herr, Brooklyn	3	Yellow	Medium	5,044	112	62.5	114	92	149
White Cap	L. C. Root & Son, Farmington	1	Yellow	Medium	6,268	128	83.6	121	94	0
White Cap	Henry Squires, New Milford	1	Yellow	Medium	3,717	88	59.3	103	98	38
White Cap	N. S. Strong, North Plain	2	White	Early	3,402	62	45.9	79	102	115
White Cap	Joseph Whathley, Kent	1	Yellow	Medium	3,497	104	43.7	114	96	544
White Cap	West Branch Seed Growers' Assn., Williamsport, Pa.	1	Yellow	Late	7,871	161	109.9	159	89	32
Woodford's Dent	G. C. Woodford, Plainville	2	Yellow	Medium	4,928	117	42.2	89	91	553

TABLE VI SILAGE CORN GROWN AT STORRS.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Per cent. dry matter		Actual green matter tons per acre.	Relative green matter per cent.	Actual dry matter per cent.	Relative dry weight per cent.
					per cent.	relative.				
Bahler's White Dent	Adolph Bahler, Ellington	4	White	Early	27.2	134	11.8	59	3.3	80
Brewer's Dent	N. H. Brewer, Hockanum	7	Yellow	Late	24.3	119	14.4	68	3.2	79
Century Dent	S. M. Waldron, New Milford	6	Yellow	Early	27.4	134	12.5	60	3.4	80
Connecticut Dent	C. L. Howes, Stamford	4	Yellow	Medium	25.6	124	13.0	61	3.3	76
Cornell No. 11	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	2	Yellow	Early	28.5	136	11.2	57	3.3	79
Cornell No. 12	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	2	Yellow	Early	27.7	131	11.9	60	3.4	79
Curtain's Yellow Dent	E. Curtain, East Windsor	1	Yellow	Late	23.6	117	14.6	66	3.6	82
Dibble's Yellow Dent	Dibble Seed Co., Honeoye Falls, N. Y.	2	Yellow	Medium	26.0	126	13.2	61	3.3	73
Dowd Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	25.1	123	14.4	71	3.4	82
Eureka	Ross Bros. Seed Co., Worcester, Mass.	7	White	Very late	20.4	100	21.2	100	4.3	100
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill	3	Yellow	Late	24.5	119	15.5	71	3.7	82
Gelston's Ensilage	W. I. Gelston, East Haddam	5	Yellow	Late	23.2	109	15.8	75	3.6	81
Golden Dent	P. H. Woodford, Avon	6	Yellow	Medium	23.2	114	14.0	64	3.3	72
Golden Dent	Alex Smith, Clintonville	2	Yellow	Medium	23.9	122	11.9	58	2.9	73
Gold Nugget Flint	Mary Bacon, Kent	4	Yellow	Medium	25.4	126	12.8	61	3.2	75
Hastings Dent	W. S. Hastings, Somers	1	Yellow	Very early	34.7	172	7.3	47	2.6	80
Hazenhurst White Cap	E. Hazen, Haddam	2	Yellow	Medium	26.0	123	16.0	80	4.3	99
Herr's Yellow Dent	W. F. Herr, Brooklyn	1	Yellow	Early	32.4	148	13.6	54	4.3	77
Hickory King	Harry Carter, Guilford	3	Yellow	Early	27.5	136	12.9	63	3.5	86
Early Huron	Joseph Harris Co., Coldwater, N. Y.	1	Yellow	Early	29.9	148	9.7	40	2.7	57
Early Huron	M. H. Williams, Sunderland, Mass	2	Yellow	Early	28.0	135	11.7	54	3.1	69
Johnson's Dent	J. W. Moss, West Cheshire	2	Yellow	Late	24.0	114	16.1	79	4.0	93
Klondyke	George Hale, Westport	4	Yellow	Very late	21.5	106	16.7	79	3.6	83
Lakeside Dent	N. Jones, South Windsor	4	Yellow	Medium	24.8	122	14.3	70	3.8	90
Lakeside Dent	S. H. Peckham, Woodstock	2	Yellow	Medium	24.9	129	10.8	59	2.8	80
Leaming	Heman Beardsley, Roxbury	6	Yellow	Medium	25.2	123	14.9	71	3.7	86
Leaming	Farm Dept., Conn. Agric. College, Storrs	2	Yellow	Late	21.7	107	18.6	85	4.1	95
Leaming	Hurley Grant Hardware Co., Willimantic	1	Yellow	Late	19.4	106	15.6	73	3.1	78
Leaming	Thomas Griswold, Wethersfield	1	Yellow	Late	22.5	112	13.2	60	3.0	69
Leaming	Harrison Hamilton, Ellington	4	Yellow	Medium	26.2	129	12.0	59	3.2	77
Leaming	Ed. Harris, Middletown	1	Yellow	Medium	24.1	120	13.4	61	3.1	72
Leaming	W. A. Lanterman, Fairfield	2	Yellow	Medium	25.2	120	16.6	83	4.2	97
Leaming	Feed Store, Norwich	1	Yellow	Very late	20.0	99	7.3	46	1.4	43
Leaming	F. S. Prince, Xenia, Ohio	2	Yellow	Late	24.3	116	16.4	82	4.0	93
Leaming	W. H. Strong, Avon	4	Yellow	Medium	26.3	129	12.4	61	3.3	82
Leaming	Vinehill Farm, Elmwood	2	Yellow	Early	28.2	134	12.3	63	3.4	80
Leaming	W. J. Wells, South Deerfield, Mass	1	Yellow	Medium	23.4	128	11.8	55	2.8	71
Long Island Dent	C. E. Salmon, Brooklyn	1	Yellow	Early	28.3	140	9.5	61	2.8	88
Long's Champion Dent	Whitehorse Farms, Paoli, Pa.	1	Yellow	Very late	19.2	90	21.2	108	3.9	92
Longfellow Flint	F. S. Platt Seed Co., New Haven	1	Yellow	Early	26.2	130	11.3	52	2.9	67
Luce's Favorite	Suffolk Co-operative Assoc., Mattituck, N. Y.	2	Yellow	Late	23.3	111	16.8	83	3.8	90
Mammoth White Flint	O. S. Olmsted, Hazardville	3	White	Medium	25.3	122	14.5	68	3.5	80
Mammoth Yellow Flint	Louis Rosensweig, South Canterbury	1	White	Medium	24.9	124	12.5	57	3.2	73
Mastodon	S. D. Woodruff Seed Co., Orange	1	Yellow	Late	23.7	....	14.3	65	3.4	....
Mastodon	E. G. Packard, Dover, Delaware	7	Yellow	Very late	19.6	96	21.0	100	4.2	96
Mastodon	F. S. Platt Seed Co., New Haven	1	Yellow	Late	24.1	120	15.8	72	3.7	86
Early Michigan	G. A. Erskine, Guilford	2	Yellow	Medium	25.9	129	13.6	66	3.5	84
Minnesota No. 13	W. A. Stocking & Sons, Weatogue	1	Yellow	Very early	31.6	156	8.4	53	2.8	86
Minnesota White Cap	C. S. Griswold, West Hartford	4	Yellow	Medium	25.5	124	13.5	64	3.5	80
Northern White Dent	B. W. Bishop, Guilford	5	White	Late	22.3	109	17.2	85	3.8	92
Peck's Yellow Dent	W. O. Peck, East Haddam	2	Yellow	Early	28.9	138	14.1	70	4.1	96
Pride of the North	Connecticut Agricultural College, Storrs	7	Yellow	Early	26.2	128	12.4	59	3.3	75
Pride of the North	I. N. Hollister, Glastonbury	1	Yellow	Early	25.7	128	12.3	56	3.2	75
Pride of the North	L. W. Kirk, Hamden	1	Yellow	Early	26.7	132	11.9	76	3.2	98
Pride of the North	H. J. Larkham, Norwichtown	1	Yellow	Early	27.3	135	10.0	64	2.9	91
Red Cob	Platt Seed Co., New Haven	1	White	Late	20.3	101	18.7	85	3.6	83
Reynolds' Yellow Dent	W. W. Reynolds, New Britain	1	Yellow	Medium	26.1	129	9.3	59	2.7	85
Sanford White Flint	Jesse St. John, Kent	4	White	Early	26.2	130	12.3	58	3.2	75
Sharon White Cap	E. K. Dean, Sharon	3	Yellow	Early	28.6	142	11.4	56	3.2	78
Silver King	Roy McDonald, Menomonie, Wisconsin	2	White	Early	28.4	135	11.9	58	3.5	82
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	2	Yellow	Early	29.4	137	9.3	41	2.6	50

TABLE VI SILAGE CORN GROWN AT STORRS—*Concluded*.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Per cent. dry matter: per cent.	Per cent. dry matter: relative.	Actual green matter tons per acre.	Relative green matter per cent.	Actual dry matter per cent.	Relative dry weight per cent.
Sutton's Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	24.8	122	13.9	68	3.5	83
Sweepstakes	West Branch Seed Growers Assn., Williamsport, Pa.	1	Yellow	Medium	28.4	130	19.6	76	5.4	98
Sweepstakes	Alex Smith, Clintonville	1	Yellow	Late	21.9	109	15.2	96	3.4	105
Sweepstakes	S. L. Hollister, Washington	1	Yellow	Late	22.3	110	12.9	82	3.1	95
Tryon Dent	J. E. Daniels, Middletown	1	Yellow	Early	26.2	130	11.1	50	3.1	71
U. S. Dept. of Agric. No. 119	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	2	White	Very late	21.1	100	20.7	101	4.4	101
U. S. Dept. of Agric. No. 125	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	1	Yellow	Medium	26.1	120	18.1	72	4.7	85
U. S. Dept. of Agric. No. 133	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	2	Yellow	Very early	30.0	143	9.5	46	2.8	63
U. S. Dept. of Agric. No. 193	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	1	Yellow	Late	23.1	114	11.4	73	2.8	86
Webber's Dent	Willis Frost, Bridgewater	5	Yellow	Medium	24.5	119	13.8	68	3.4	81
Webber's Dent	Dept. Plant Breeding, Cornell Univ., Ithaca, N. Y.	2	Yellow	Early	30.8	146	9.9	50	3.1	73
White Cap	G. D. Hall, Wallingford	2	Yellow	Early	27.0	134	9.7	43	2.7	59
White Cap	W. F. Herr, Brooklyn	2	Yellow	Early	28.2	134	13.5	66	3.9	90
White Cap	L. C. Root & Son, Farmington	1	Yellow	Early	29.6	135	14.4	57	4.3	77
White Cap	N. S. Strong, North Plain	2	Yellow	Early	26.7	130	9.2	52	2.5	72
White Cap	West Branch Seed Growers Assn., Williamsport, Pa.	1	Yellow	Medium	28.0	128	18.4	73	5.2	95
Woodford's Dent	G. C. Woodford, Plainville	2	Yellow	Medium	24.0	125	11.0	62	2.6	75

DESCRIPTION OF VARIETIES.

Here follow decriptions of all varieties and strains tested. All are not illustrated. In all cases, the cut is for the variety description immediately below it.

FLINT VARIETIES.

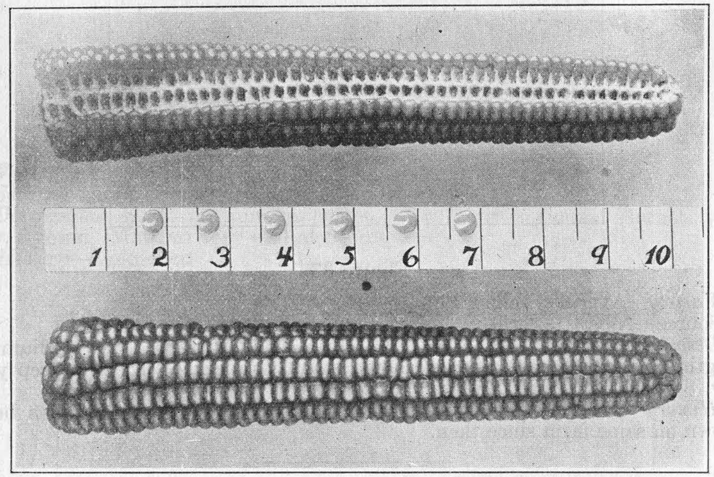

Figure 32.

Variety—Argentine Flint.
Source—S. D. LaBarr, Greenwich.*
Description—Stalk medium in height and size, with many suckers. Ear medium in length, large at butt and tapering. Kernels yellow, medium size, 12-14 rows. Matures well at Storrs.
History—Obtained seed in 1914 from a farmer near Buffalo, N. Y.

*All localities are in Connecticut unless otherwise noted.

FLINT VARIETIES—*Continued.*

Variety—Avery's White Flint.
Source—B. T. Avery, Ledyard.
Description—Stalk short, medium in diameter with many suckers. Ear long and cylindrical. Kernels white, medium size, 8 rows. Matures well at Storrs.
History—Unknown.

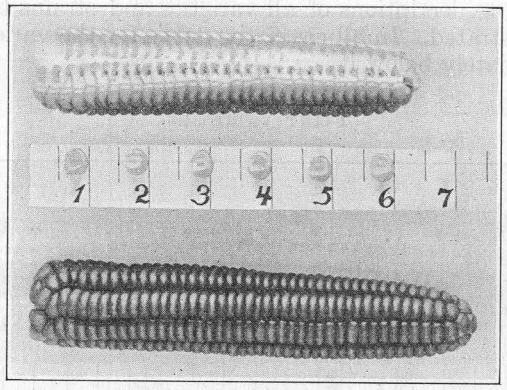

Figure 33.

Variety—Averill's Yellow Flint.
Source—Albert Averill, Pomfret Landing.
Description—Stalk short and small, with many suckers. Ear medium in length, small in diameter, small shank, slightly tapering. Kernels deep yellow, 8 rows. Matures very well at Storrs.
History—Seed obtained from Vermont about 40 years ago and has been grown on same farm since then.

Variety—Barnes White Flint.
Source—F. A. Barnes, Preston City.
Description—Stalk medium in height and diameter, with many suckers. Ear long and cylindrical. Kernels white, medium in size, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Beebe's Yellow Flint.
Source—C. M. Beebe, Uncasville.
Description—Stalk medium in height and diameter, with many suckers. Ears medium in length, large in diameter. Kernels yellow, large, 8 rows. Matures very well at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

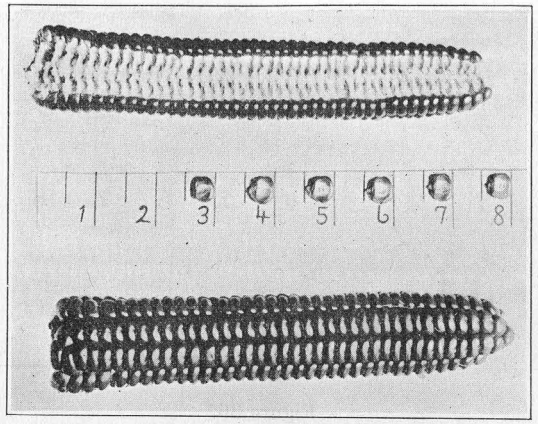

Figure 34.

Variety—Brewer's Flint.
Source—N. H. Brewer, Hockanum.
Description—Stalk medium in height, with many suckers. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Unknown.

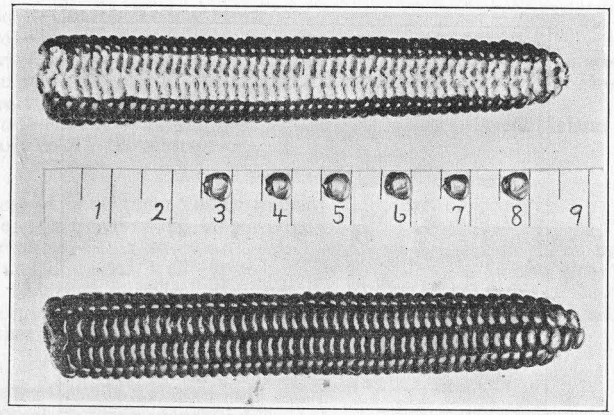

Figure 35.

Variety—Burwell's Flint.
Source—E. E. Burwell, New Haven.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length and diameter. Kernels yellow, medium size, 8 rows. Matures well at Storrs.
History—A selection of Canada Yellow Flint. Grown 25 years by Mr. Burwell.

FLINT VARIETIES—*Continued.*

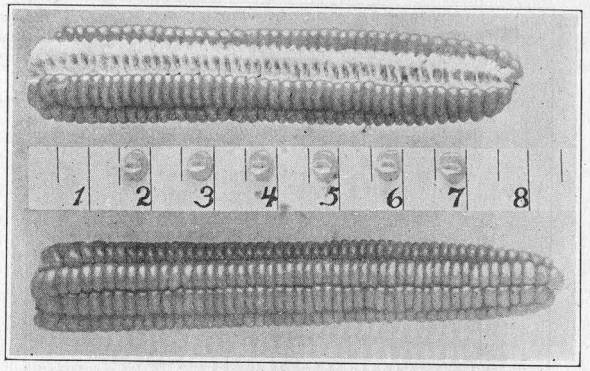

Figure 36.

Variety—Canada Yellow Flint.
Source—Thomas Griswold and Sons, South Wethersfield.
Description—Stalk medium in height, large in diameter, with few suckers. Ear medium in length, cylindrical. Kernels yellow, medium size, 8 rows. Matures well at Storrs.
History—Grown for at least 12 years.

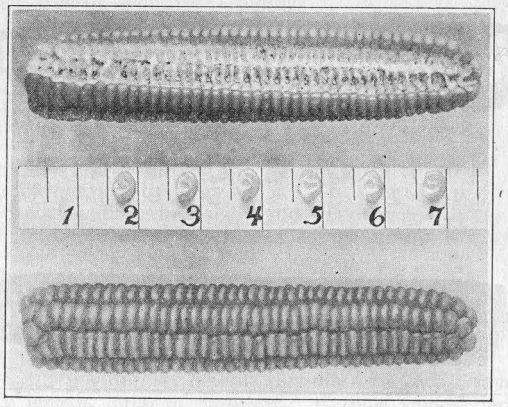

Figure 37.

Variety—Canada Yellow Flint.
Source—Jason Lathrop, Plainfield.
Description—Stalk short, medium in size and number of suckers. Ear medium in length and diameter, cylindrical, small shank. Kernels yellow, medium size, 8 rows. Matures very well at Storrs.
History—Grown for 50 years on same farm.

FLINT VARIETIES—*Continued.*

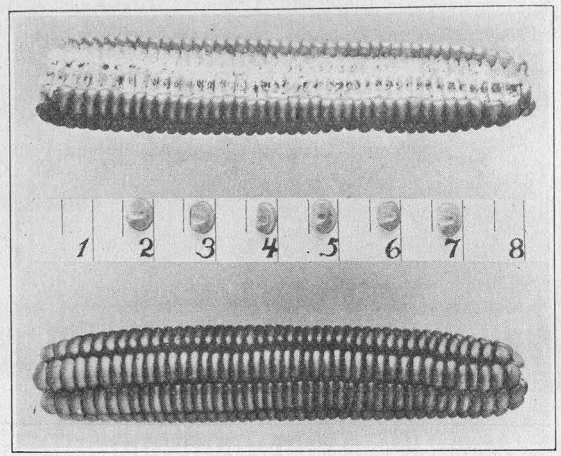

Figure 38.

Variety—Chace's Yellow Flint.
Source—M. W. Chace, Pomfret Landing.
Description—Stalk short, medium in diameter, with many suckers. Ear medium in length, large, cylindrical. Kernels yellow, medium size, 8 rows. Matures very well at Storrs.
History—Brought into vicinity of Pomfret from Rhode Island in 1841. Originally called "Hawkins Corn."

Variety—Connecticut Yellow Flint.
Source—O. S. Olmsted, Hazardville.
Description—Stalk short and small, with many suckers. Ear medium in length and diameter, well capped. Kernels yellow, large and close together, 8 rows. Matures very well at Storrs.
History—Seed from Canada 60 years ago. Mr. Olmsted has crossed it twice with other yellow flints since then. Seed selected carefully.

Variety—Canada Yellow Flint.
Source—L. S. Abbe, Hazardville.
Description—Stalk short and small, suckers medium in number. Ear short, medium in diameter, tapering. Kernels yellow, medium size, 8 rows. Matures very well at Storrs.
History—Grown for 50 years on same farm without change.

FLINT VARIETIES—*Continued.*

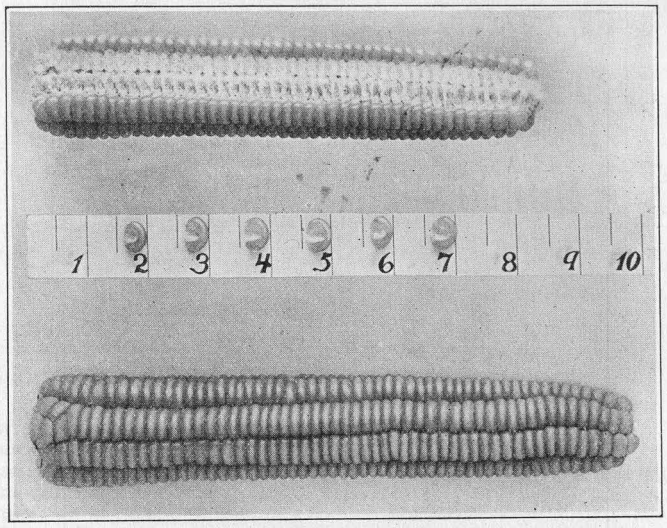

Figure 39.

Variety—Crowell's Prolific.
Source—David Crowell, Middletown.
Description—Stalk tall and large. Ear long, cylindrical. Kernels yellow, 8 rows. Matures fairly well at Storrs.
History—Grown for 100 years on the same farm, originally brought from Massachusetts.

Variety—Double Capped White Flint.
Source—W. A. Thrall, Windsor.
Description—Stalk very short and very small, with many suckers. Ear very short and very small, cylindrical, very well capped at tip and butt, shank very small. Kernels white, of medium depth and size, 8 rows. Matures very well at Storrs.
History—Unknown.

Variety—Fairview Flint.
Source—Harrison Hamilton, Ellington.
Description—Stalk short and small, with few suckers. Ear medium in length and size. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Unknown.

Variety—Fenn's 12 Row.
Source—R. M. Fenn, Middlebury.
Description—Stalk medium in height, small in diameter, with few suckers. Ear medium in length, large in diameter. Kernels dark yellow, medium depth, small, 12 rows. Matures at Storrs.
History—A selection from Basham's Longfellow.

FLINT VARIETIES—*Continued.*

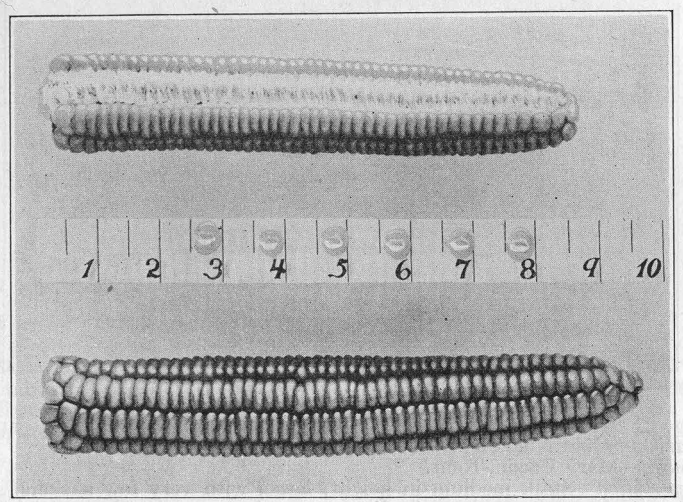

Figure 40.

Variety—Davis Yellow Flint.
Source—P. E. Davis, Granby, Mass.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Originated from a cross of a flint of the Longfellow type with a small cob, amber colored variety. Has existed as a distinct variety about 38 years.

Variety—Frost's Yellow Flint.
Source—Charles Frost, Sherman.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length, small in diameter. Kernels variable in color, largely yellow, medium depth and size. Matures well at Storrs.
History—Said to have originated as a cross of different varieties. Obtained from W. H. Taber of Quaker Hill, Pawling, New York over 40 years ago.

FLINT VARIETIES—*Continued.*

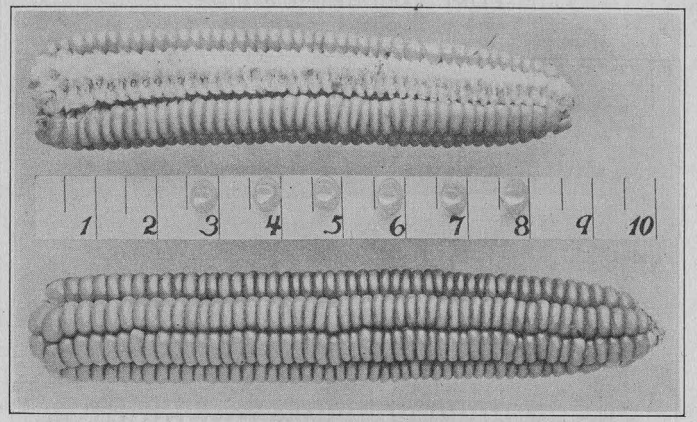

Figure 41.

Variety—Gold Nugget.
Source—Mary Bacon, Kent.
Description—Stalk medium in height, large, with very few suckers. Ear medium in length, very large in diameter, rather coarse. Kernels light yellow, medium depth, very large, 8 rows. Matures fairly well at Storrs.
History—Hall's Golden Nugget from Joseph Harris Seed Co., Coldwater, New York, grown about fourteen years in Kent. Originated by Levi P. Hall about 1873.

Variety—Gold Nugget.
Source—A. L. Purdy, Port Chester, N. Y.
Description—See Bacon's Gold Nugget.

Variety—Gold Nugget.
Source—J. B. Stratton, Watertown.
Description—See Bacon's Gold Nugget. Seed from same source.

Variety—Hathaway's Yellow Flint.
Source—Auburn, Maine.
Description—Stalk short and small, with few suckers. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

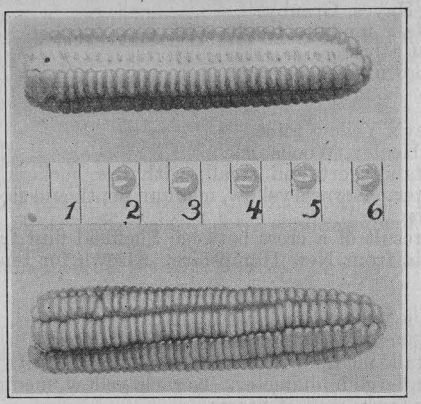

Figure 42.

Variety—Griswold's 90 Day.
Source—Thomas Griswold and Sons, Wethersfield.
Description—Stalk short and small, with few suckers. Ear short and small, cylindrical, well capped, small shank. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Known to have been grown in the vicinity for at least 12 years.

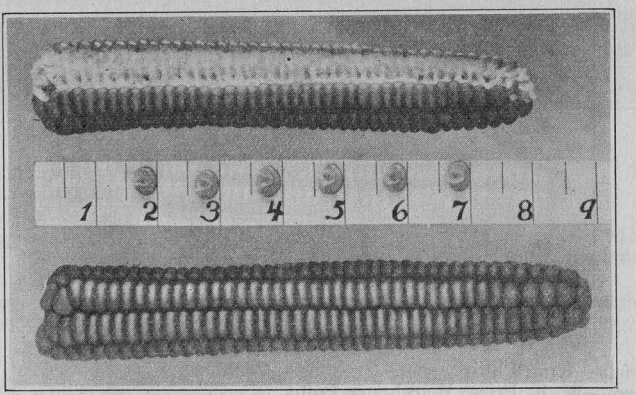

Figure 43.

Variety—Hauschild's Yellow Flint.
Source—Julius Hauschild, Storrs.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length. Kernels variable in color, mostly yellow, 8 rows. Matures well at Storrs.
History—Has been mixed with other strains of different color.

FLINT VARIETIES—*Continued.*

Variety—Hayes' Canada Flint.
Source—M. C. Hayes, Granby.
Description—Stalk medium height with many suckers. Kernels yellow, 8 rows. Matures at Storrs.
History—Unknown.

Variety—Healey's Yellow Flint.
Source—L. H. Healey, Woodstock.
Description—Stalk short and small, with few suckers. Ear medium in length and diameter. Kernels yellow, medium depth and size, 8 rows. Matures very well at Storrs.
History—The result of a cross between Sheffield flint from Massachusetts and Early Canada from New Hampshire. Grown for ten years.

Variety—Isben's Yellow Flint.
Source—J. C. Isben, North Haven.
Description—Stalk medium in height and diameter with few suckers. Ear medium in length, large in diameter. Kernels yellow, medium depth and size, 8 rows. Matures fairly well at Storrs.
History—Seed obtained from F. S. Platt Seed Co. about 14 years ago.

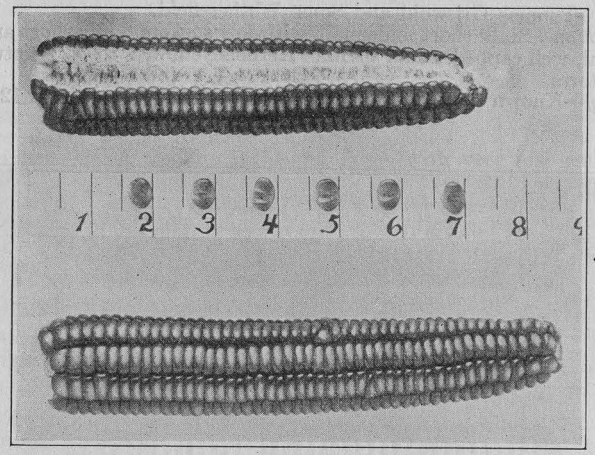

Figure 44.

Variety—King Philip.
Source—W. E. Price, Warehouse Point.
Description—Stalk medium in height and diameter with few suckers. Ear rather short, medium diameter, cylindrical, well capped. Kernels red, of medium depth and size, 8 rows. Matures very well at Storrs.
History—Brought from Rhode Island about 35 years ago.

FLINT VARIETIES—*Continued.*

Variety—Longfellow.
Source—John Basham, Middlebury.
Description—Stalk medium in height and diameter and number of suckers. Ear long and small in diameter. Kernels dark yellow, medium depth and size, 8 rows. Matures at Storrs.
History—Unknown.

Variety—Longfellow.
Source—P. J. Behan, Roxbury.
Description—Stalk medium in height and diameter, with few suckers. Ear long, small in diameter. Kernels yellow, shallow, medium size, 8 rows. Matures well at Storrs.
History—Mr. Behan selects his seed from stalks with two ears.

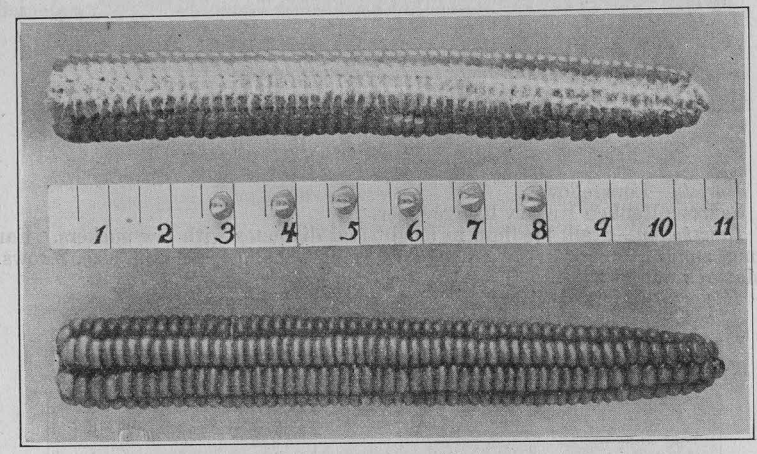

Figure 45.

Variety—Longfellow.
Source—N. G. Gelston, Sherman.
Description—Stalk of medium height, rather small in diameter, with few suckers. Ear long, small in diameter. Kernels yellow, shallow, medium size, 8 rows. Matures well at Storrs.
History—Mr. Gelston has grown this strain for 10–15 years. Uncertain as to source. Selects his seed at husking.

Variety—Longfellow.
Source—F. S. Platt Seed Co., New Haven.
Description—Stalk medium in height. Ear long. Kernels yellow, 8 rows. Matures well at Storrs.
History—Seed grown in Connecticut.

FLINT VARIETIES—*Continued.*

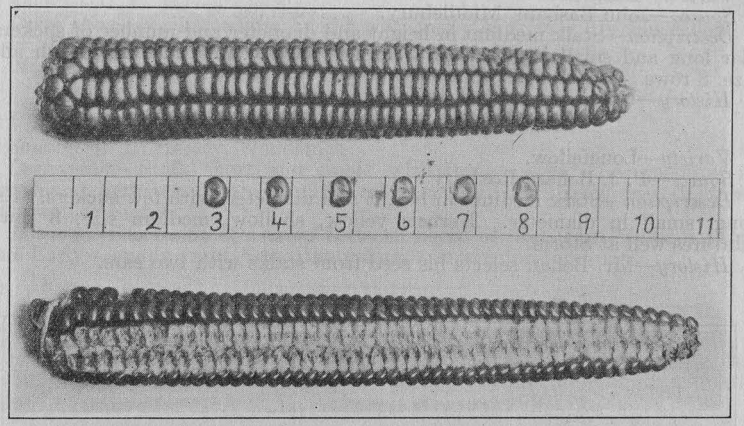

Figure 46.

Variety—Longfellow.
Source—Reuben Keeler, Bridgewater.
Description—Stalk medium in height and diameter with few suckers. Ear long, small in diameter. Kernels dark yellow, shallow, medium size, 8 rows. Matures well at Storrs.
History—Is mixed with Pied Flint, a variety of similar type.

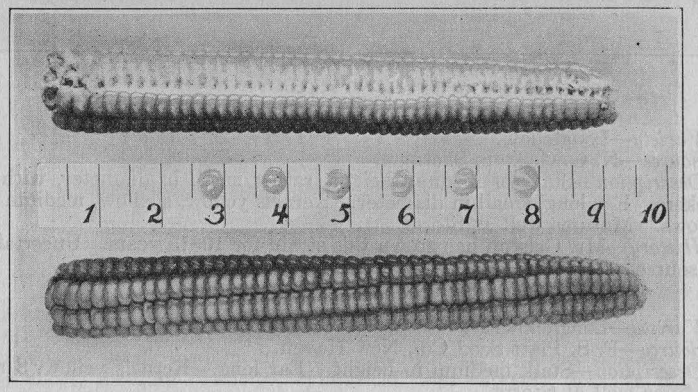

Figure 47.

Variety—Longfellow.
Source—N. R. Mosher, Sherman.
Description—See Keeler's Longfellow.
History—Unknown.

FLINT VARIETIES—*Continued.*

Variety—Longfellow.
Source—C. H. Savage, Storrs.
Description—Stalk medium in height. Kernels yellow, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Mammoth White Flint.
Source—O. S. Olmsted, Hazardville.
Description—Stalk tall and large, with few suckers. Ear long and large in diameter. Kernels white, 8 rows. Matures at Storrs.
History—Unknown.

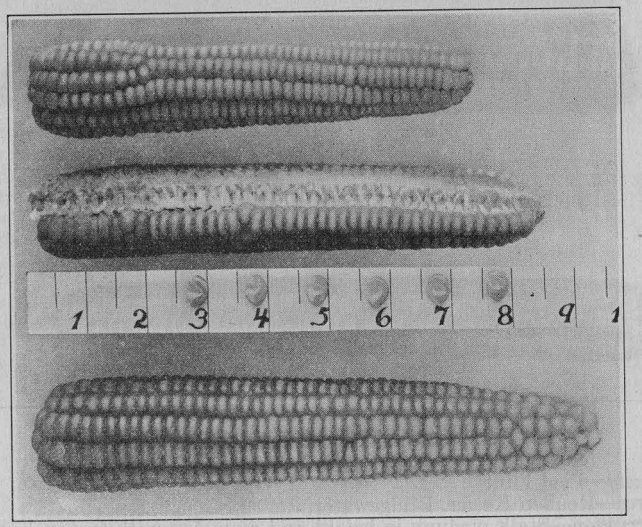

Figure 48.

Variety—Mammoth Yellow Flint.
Source—Louis Rosensweig, South Canterbury.
Description—Stalk tall. Ear long, small shank, slightly tapering. Kernels light yellow, 8–12 rows. Matures at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

Variety—McLean's Flint.
Source—J. B. McLean, Simsbury.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length and diameter, cylindrical. Kernels yellow, medium depth and size, 8 rows. Matures well at Storrs.
History—Mr. McLean crossed a strain of Canada Yellow Flint with a much larger variety ten years ago and by careful selection since then has obtained the corn described here. It has won several prizes at corn shows.

Variety—Montgomery's White Flint.
Source—Phelps Montgomery, Mt. Carmel.
Description—Stalk medium in height, many suckers. Ear medium in length. Kernels white, 8 rows. Matures at Storrs.
History—Seed purchased from Peter Henderson Seed Co., grown several years in Connecticut.

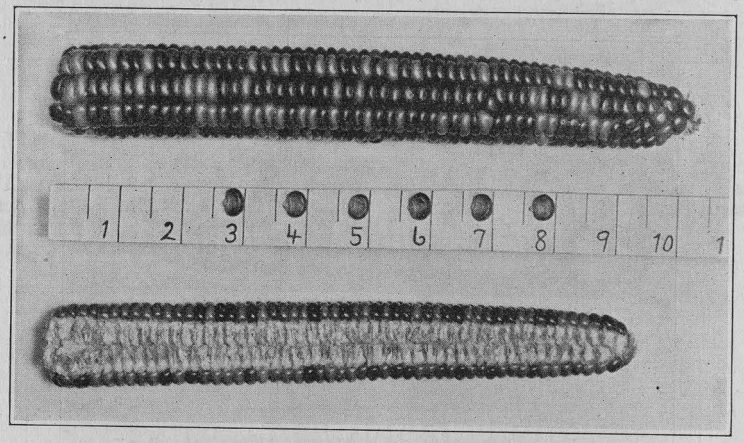

Figure 49.

Variety—Pied Flint.
Source—Reuben Keeler, Bridgewater.
Description—Stalk medium in height and diameter, with few suckers. Ear long, rather small in diameter, cylindrical. Kernels vary in color, white or yellow, rather shallow, of medium size, 8 rows. Matures fairly well at Storrs.
History—This variety is the result of crossing yellow and white flints. Has been grown for sixty years. Seed obtained from Lyman Smith. Selects seed at husking.

Variety—Red Flint.
Source—Albert Hale, South Coventry.
Description—Stalk short. Ear medium in length. Kernels red, 8 rows. Matures very well at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

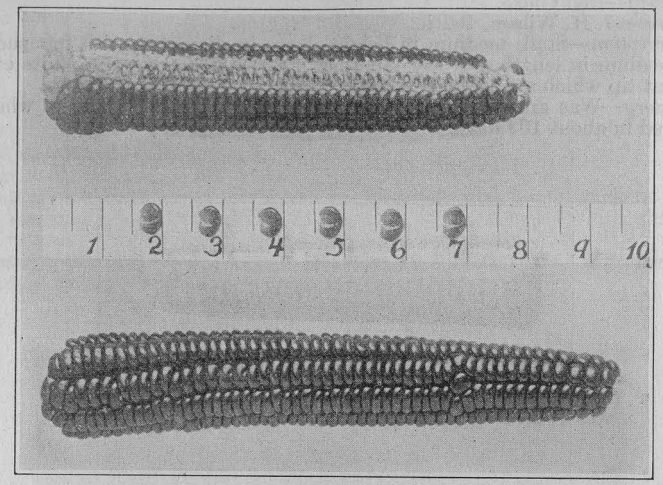

Figure 50.

Variety—Red Flint.
Source—Benjamin Neleber, Colchester.
Description—Stalk medium in height and diameter, with few suckers. Ears medium in length and diameter. Vary in color, red or yellow and white. Matures well at Storrs.
History—Unknown.

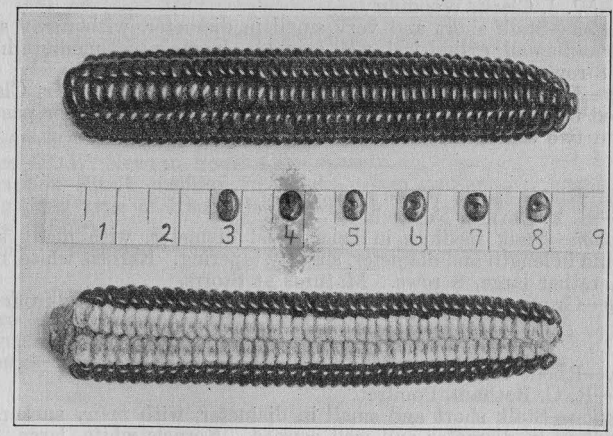

Figure 51.

Variety—Red Flint.
Source—S. F. Brown, Windsor.
Description—Stalk medium in height, diameter and number of suckers. Ear medium in length. Kernels red, medium size and depth, 8 rows. Matures very well at Storrs.
History—Is a strain of King Philip known as Hill's Red Flint.

FLINT VARIETIES—*Continued.*

Variety—Red Glaze.
Source—J. H. Wilson, Baltic.
Description—Stalk medium in height, large in diameter, with few suckers. Ear medium in length, slightly tapering, well capped. Kernels white except those at tip which are pinkish, 8 rows. Matures very well at Storrs.
History—Was grown in South Swansea, Mass., for many years, where it matured in about 105 days.

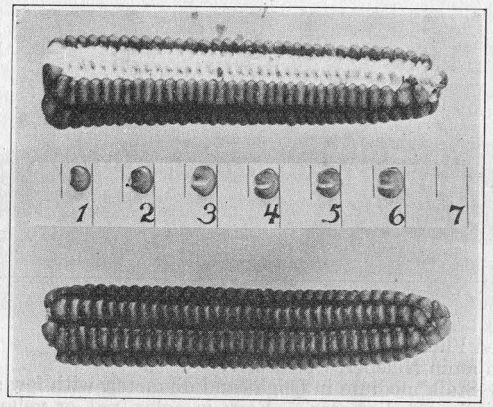

Figure 52.

Variety—Rhode Island Premium.
Source—W. J. Clark, Woodbury.
Description—Stalk short and very small in diameter, with many suckers. Ear short and small, cylindrical, well capped. Kernels red, medium in depth and size, 8 rows. Matures very well at Storrs.
History—Has been grown on same farm for thirty years. Mr. Clark obtained seed from R. W. Martin of Woodbury. Selected seed for past seven years from two and three-eared stalks.

Variety—Rhode Island White Flint.
Source—E. P. Barnes, Norwich.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length and diameter, slightly tapering. Kernels white, medium in depth, rather large, 8 rows. Matures at Storrs.
History—Grown forty years on the same farm. Originally from Rhode Island.

Variety—Rhode Island White Flint.
Source—R. C. Botham, Pomfret.
Description—Stalk short and small in diameter, with many suckers. Ear short, medium in diameter and well capped. Kernels white, large, 8 rows Matures well at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

Variety—Rhode Island White Flint.
Source—W. P. Briggs, Lebanon.
Description—Stalk short and small in diameter, with many suckers. Ear short, medium in diameter, cylindrical, well capped. Kernels white, shallow, large, 8 rows. Matures well at Storrs.
History—Mr. Briggs has grown this variety for 30 years. Obtained his seed from Robert Carpenter, also of Lebanon.

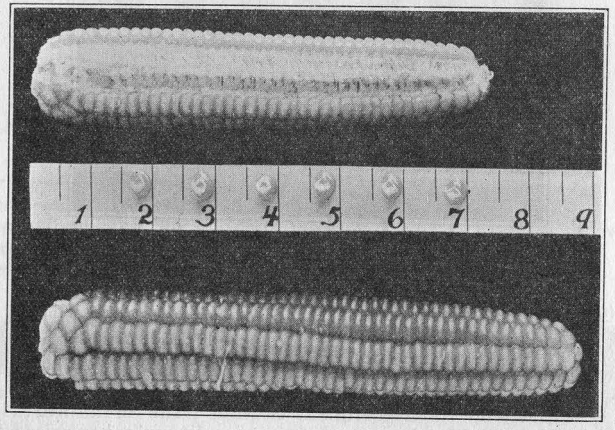

Figure 53.

Variety—Rhode Island White Flint.
Source—F. W. Newton, South Canterbury.
Description—Stalk medium in height. Ear medium in length, slightly tapering, long type of Rhode Island White. Kernels white, large, 8 rows. Matures at Storrs.
History—Unknown.

Variety—Rhode Island White Flint.
Source—A. A. Young, Jewett City.
Description—See R. I. Exper. Station's White Flint
History—Originally from Rhode Island Experiment Station.

FLINT VARIETIES—*Continued.*

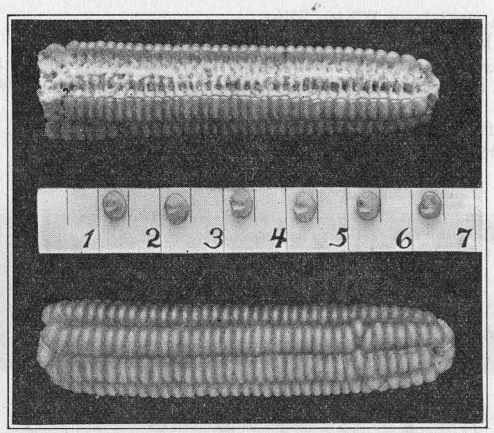

Figure 54.

Variety—Rhode Island White Flint.
Source—Rhode Island Experiment Station, Kingston, R. I.
Description—Stalk medium in height, small in diameter, with many suckers. Ear short, medium in diameter, well capped. Kernels white, medium depth and size, 8 rows. Matures well at Storrs.
History—Grown on the Experiment Station farm for at least 10 years. Originally from F. E. Marchant in the same locality who has raised this corn for a long period of time.

Variety—Root's Yellow Flint.
Source—L. C. Root, Farmington.
Description—Ear short and very small. Kernels yellow, shallow, medium in size, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Sanford White Flint.
Source—C. E. Hough, Washington.
Description—See St. John's Sanford White Flint.
History—Mr. Hough obtained his seed from Albert Carlson of New Milford, who in turn obtained his from Kent.

FLINT VARIETIES—*Continued.*

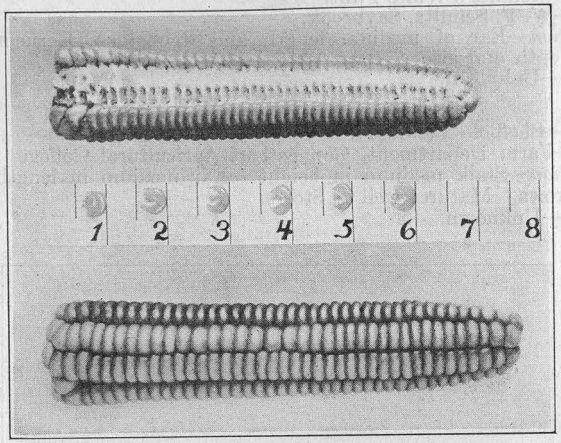

Figure 55.

Variety—Rosebrooks' Flint.
Source—Charles Rosebrooks, Storrs.
Description—Stalk short. Ear medium length. Kernels yellow, 8 rows. Matures well at Storrs.
History—Grown for nearly fifty years on same farm.

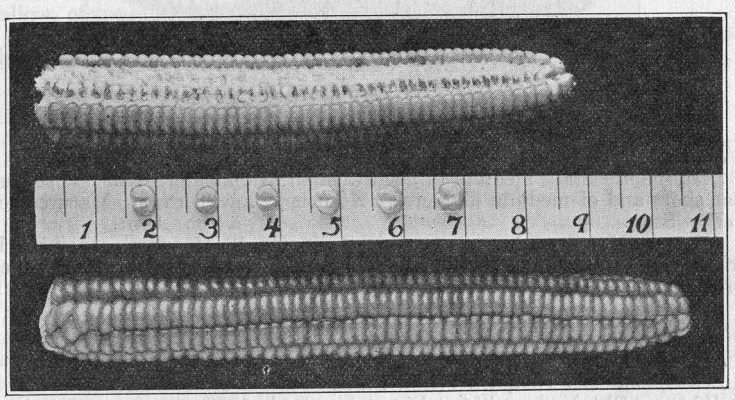

Figure 56.

Variety—Sanford White Flint.
Source—Jesse St. John, Kent.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length and diameter, cylindrical. Kernels white, of medium depth and size, 8 rows. Matures well at Storrs.
History—Grown for 30 years or more on the same farm. Original source unknown.

FLINT VARIETIES—*Continued.*

Variety—Schultz's White Flint.
Source—W. F. Schultz, Saybrook.
Description—Ear of medium length and diameter. Kernels white, of medium depth and size, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Sheffield Yellow Flint.
Source—Farm Department, Connecticut Agricultural College, Storrs.
Description—Stalk medium in height. Ear medium in length. Kernels yellow, 8 rows. Matures well at Storrs.
History—Unknown.

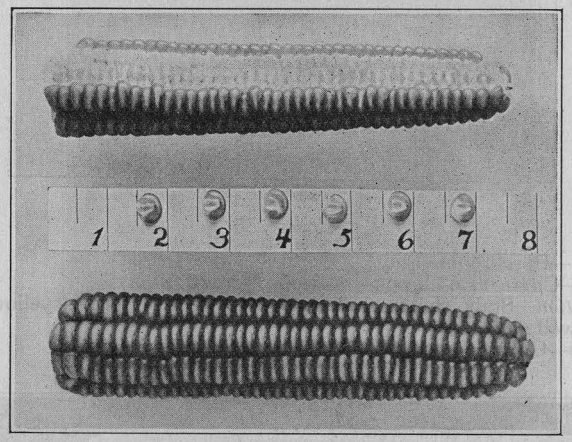

Figure 57.

Variety—Sheffield Yellow Flint.
Source—C. H. Sage, New Canaan.
Description—Stalk medium in height, small in diameter, with few suckers. Ear short and of medium diameter. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Mr. Sage has grown this strain for 12–15 years, obtaining his original seed from James Cahill, Sheffield, Mass., and two years ago from Peck Brothers, Sheffield, Mass.

Variety—Sheffield Yellow Flint.
Source—C. E. Borger, New Preston.
Description—See Healey's Yellow Flint.
History—Obtained seed from Massachusetts in 1909.

Variety—Silver Triumph.
Source—C. J. Anderson, New Preston.
Description—Stalk medium in height, large in diameter, with few suckers. Ear medium in length, large in diameter; kernels white, deep, large, 8 rows. Matures fairly well at Storrs.
History—Mr. Anderson obtained his seed in 1920 from A. A. Biery Seed Co., Clarinda, Iowa. Matured in 100 days in 1920.

FLINT VARIETIES—*Continued.*

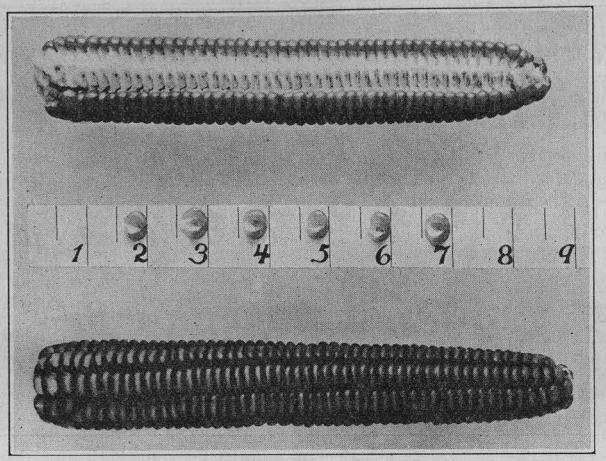

Figure 58.

Variety—Skilton's Yellow Flint.
Source—Julius Skilton, Watertown.
Description—Stalk of medium height and diameter, with few suckers. Ear medium in length, small in diameter, tapers very little. Kernels dark yellow, shallow, of medium size, 8 rows. Matures well at Storrs.
History—Has been grown for fifty-three years on the same farm. Seed selected very carefully at husking time. Originally from New York.

Variety—Smut Nose Flint.
Source—G. A. Skilton, Watertown.
Description—Stalk medium in height, small in diameter. Ear medium in length and diameter. Kernels white, except those at tip, which are pinkish, of medium depth and size, 8 rows. Matures well at Storrs.
History—Grown for 40 years on the same farm. Originally from Robert Skilton.

Variety—Stickney's Yellow Flint.
Source—G. E. Stickney, Newburyport, Mass.
Description—Stalk of medium height and diameter, with few suckers. Ear medium in length and diameter, cylindrical. Kernels yellow, 8 rows. Matures well at Storrs.
History—This variety is the result of crossing and careful selection of the hybrid for cylindrical well-capped ears.

Variety—Stickney's Yellow Flint.
Source—L. J. Grant, Wapping.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length, small in diameter. Kernels yellow, shallow, of medium size, 8 rows. Matures well at Storrs.
History—See G. E. Stickney's Yellow Flint.

FLINT VARIETIES—*Continued.*

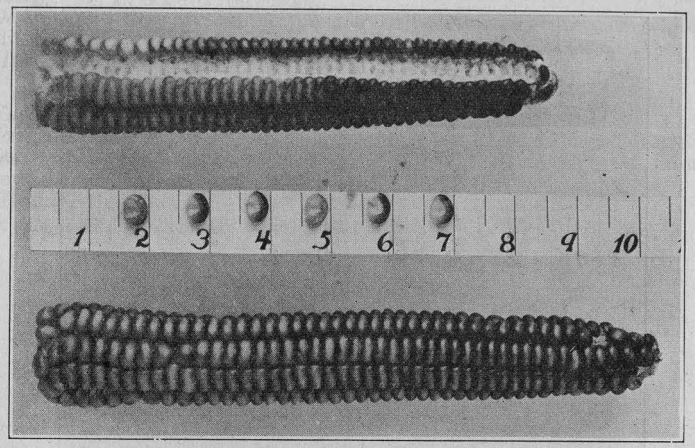

Figure 59.

Variety—Smut Nose Flint.
Source—Robert Skilton, Morris.
Description—See G. A. Skilton's Smut Nose White Flint.
History—Mr. Skilton and his father have grown this variety for 62 years on the same farm. Select seed at husking.

Variety—Taylor's Yellow Flint.
Source—G. E. Taylor, Shelburne, Mass.
Description—Stalk medium in height, diameter and number of suckers. Ear medium in length. Kernels dark yellow, 8 rows. Matures very well at Storrs.
History—Brought from South Hadley in 1814 and raised on the same farm for 110 years.

Variety—U. S. Department of Agriculture No. 193.
Source—Office of Cereal Investigations, B. of P. I., Washington, D. C.
Description—Stalk tall and large with few suckers. Ear medium in length, very large in diameter, resembling "Gold Nugget." Kernels light yellow, deep, very large, 8 rows. Does not mature well at Storrs.
History—A selection from Hall's Golden Nugget secured from Jacob Kotzenstein of Hamburg, New Jersey, in 1914. Bred by the U. S. Dept. of Agriculture from 1915 to 1921 at Rhinebeck, New York. See Bacon's Gold Nugget.

Variety—Wheaton's 12 Row.
Source—E. M. Wheaton, Putnam.
Description—Stalk medium in height, small in diameter, with few suckers. Ear medium in length, large in diameter. Kernels dark yellow, shallow, small, 12 rows. Matures very well at Storrs.
History—Result of crossing 12 rowed dent with 8 rowed flint. Grown for 15 years.

FLINT VARIETIES—*Continued.*

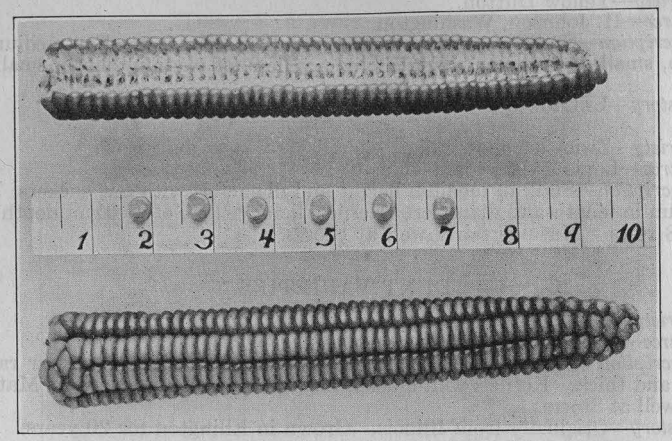

Figure 60.

Variety—Tucker's Yellow Flint.
Source—F. E. Tucker, Vernon.
Description—Stalk medium in height and diameter, with few suckers. Ear short. Kernels yellow, 8 rows. Matures well at Storrs.
History—This variety is the result of crossing Canada Yellow Flint with Holden's about thirty years ago; since then seed has been selected very carefully in the field.

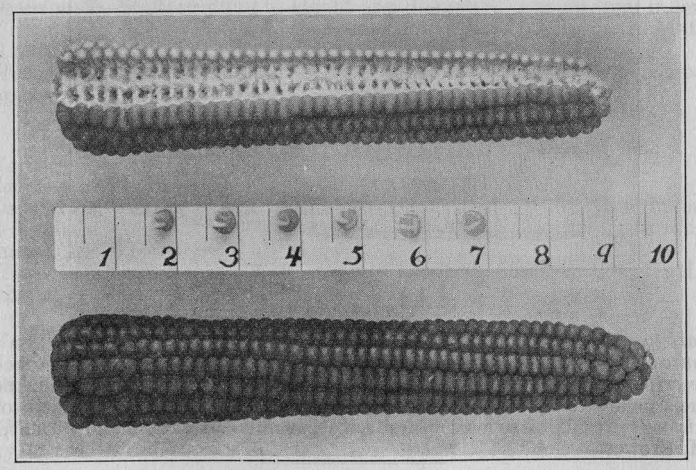

Figure 61.

Variety—Yellow Dutton.
Source—C. H. Bissell, Lakeville.
Description—Stalk of medium height and small in diameter, with a medium number of suckers. Ears medium in length, large at butts. Kernels light yellow, shallow, small, 12 rows. Matures well at Storrs.
History—Grown for fifty years by Mr. Bissell.

FLINT VARIETIES—*Concluded.*

Variety—Yellow Dutton.
Source—H. Johnson, Washington.
Description—Stalk of medium height, small in diameter. Ear medium in length, small in diameter. Kernels light yellow, of medium depth, small, 12 rows.
History—Unknown.

Variety—Zwick's Yellow Flint.
Source—Louis Zwick, Plantsville.
Description—Stalk of medium height and diameter, with few suckers. Ear medium in length and diameter. Kernels light yellow, of medium depth and size, 8 rows. Matures fairly well at Storrs.

DENT VARIETIES.

Variety—Bahler's White Dent.
Source—Adolph Bahler, Ellington.
Description—Stalk medium in height and small in diameter. Ear rather short and thick. Kernels white, deep, medium in size, 16–20 rows. Matures very well at Storrs.
History—Originally from Illinois. Grown in Ellington for 20 years.

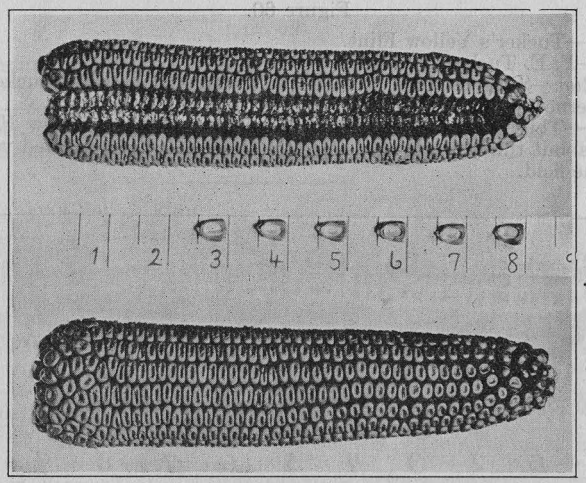

Figure 62.

Variety—Brewer's Dent.
Source—N. H. Brewer, Hockanum.
Description—Stalk tall and large. Ear medium in length and thickness. Kernels yellow, deep, rather small, 16–20 rows. Does not mature at Storrs.
History—Result of several years' selection out of Reid's Yellow Dent, by N. H. Brewer.

Variety—Brewer's Dent.
Source—B. F. Page, Durham.
Description—Stalk medium in height and diameter. Ear short and thick. Kernels yellow, 16–22 rows. Does not mature at Storrs.
History—From N. H. Brewer.

DENT VARIETIES—*Continued.*

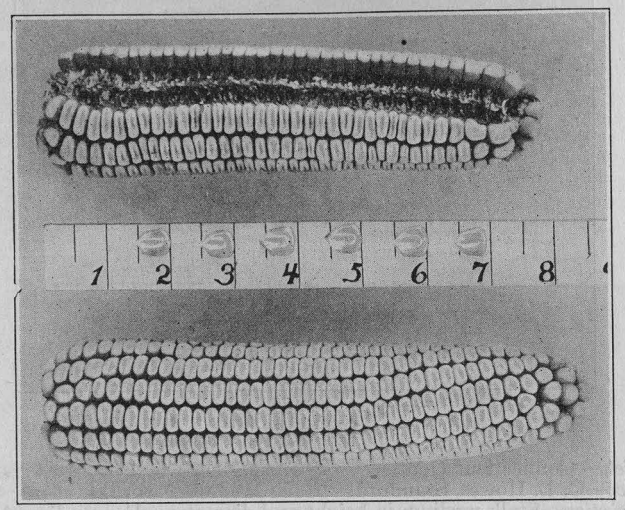

Figure 63.

Variety—Century Dent.
Source—S. M. Waldron, New Milford.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, deep, medium in size, 14–18 rows. Matures well at Storrs.
History—Bought in Buffalo, N. Y., about 1902 from a silo company. Supposed to be a pedigreed corn.

Variety—Clark's Early Wonder.
Source—Harris Seed Company, Coldwater, N. Y.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, deep, medium in size, moderately to roughly indented, 14–18 rows.
History—Obtained seed about ten years ago from Clark & Son, Wayland, Michigan.

Variety—Dibble's Yellow Dent.
Source—Dibble Seed Company, Honeoye Falls, N. Y.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, 12-16 rows. Does not mature well at Storrs.
History—A strain of Leaming selected and grown by the Dibble Seed Company.

DENT VARIETIES—*Continued.*

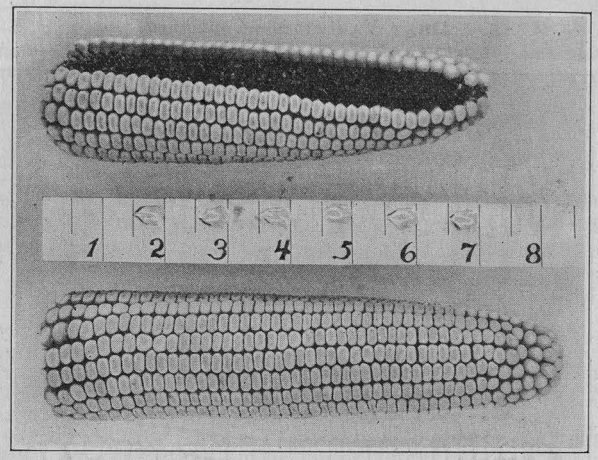

Figure 64.

Variety—Connecticut Dent.
Source—C. L. Howes, Stamford.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, 16–18 rows. Does not mature well at Storrs.
History—From Dibble's Early Yellow Dent. Bred by "ear to row" method by Mr. Howe.

Variety—Cornell No. 11.
Source—Dept. of Plant Breeding, Cornell University, Ithaca, N. Y.
Description—Stalk short and slender. Ear short and medium in diameter. Kernels yellow, mediumly deep, small, 12–20 rows. Matures very well at Storrs.
History—Isolated from Pride of the North by eight years of ear-to-row selection in Cayuga Co., New York.

Variety—Cornell No. 12.
Source—Dept. Plant Breeding, Cornell University, Ithaca, N. Y.
Description—Stalk short and slender. Ear short and large in diameter. Kernels yellow, deep, medium in size, 18–20 rows. Matures well at Storrs.
History—Isolated from Funk's 90 Day by five years of ear-to-row selection in Westchester Co., New York.

Variety—Curtin's Yellow Dent.
Source—E. Curtin, East Windsor.
Description—Stalk tall, medium in diameter. Ear long and tapering. Kernels yellow. Does not mature at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

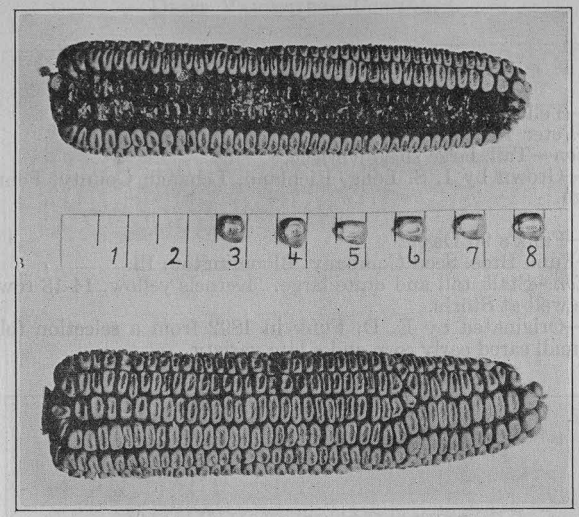

Figure 65.

Variety—Dowd Dent.
Source—R. C. Wilcox & Sons, Guilford.
Description—Stalk medium in height and diameter. Ear long. Kernels light yellow, 10-14 rows. Matures fairly well at Storrs.
History—Unknown.

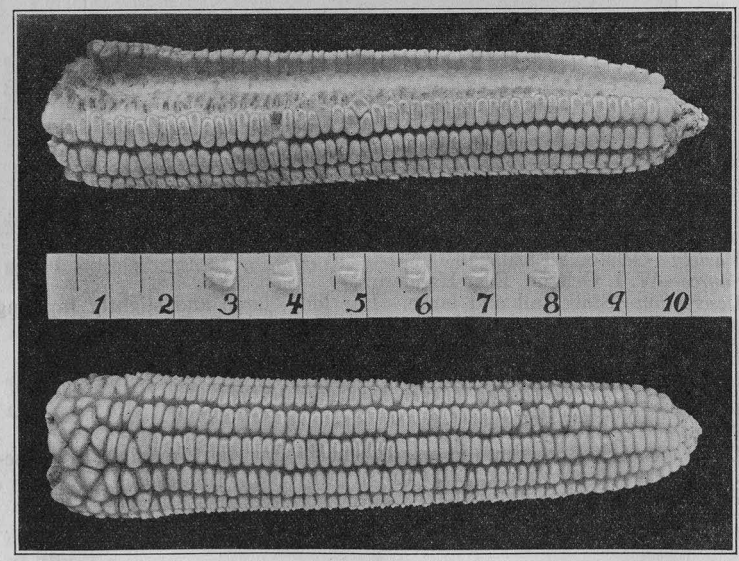

Figure 66.

Variety—Eureka.
Source—Ross Brothers Seed Company, Worcester, Mass.
Description—Stalk very tall and very large. Ear long and large. Kernels white, mediumly deep and very broad. Never matures at Storrs.
History—Grown on James River in Virginia.

DENT VARIETIES—*Continued.*

Variety—Yellow Eureka.
Source—Peter Henderson & Company, New York City.
Description—Tall, large silage variety.
History—Grown by I. S. Long, Richland, Lebanon County, Penn., about 20 years ago.

Variety—Funk's 90 Day.
Source—Funk Bros. Seed Company, Bloomington, Ill.
Description—Stalk tall and quite large. Kernels yellow, 14-18 rows. Does not mature well at Storrs.
History—Originated by E. D. Funk in 1892 from a selection following a cross of a small eared early corn and a late variety.

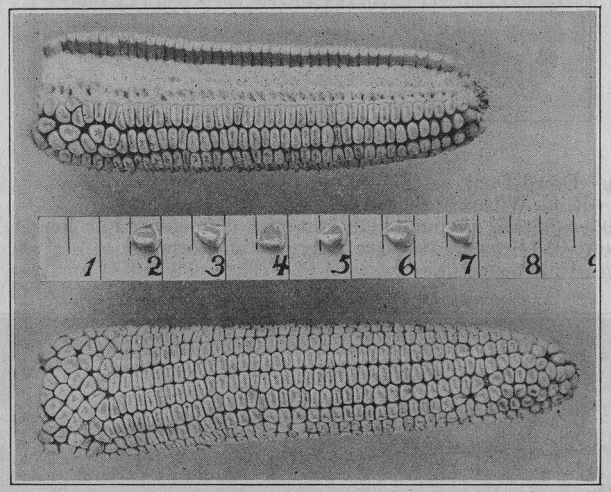

Figure 67.

Variety—Gelston's Ensilage.
Source—W. I. Gelston, East Haddam.
Description—Stalk tall and large. Ear long, large and slightly tapering Kernels yellow, roughly dented. Does not mature at Storrs.
History—The result of crossing Early Mastodon on Klondyke.

Variety—Golden Dent.
Source—Alex Smith, Clintonville.
Description—Stalk medium in height, small. Ear short, medium in diameter. Kernels reddish yellow, 12-14 rows. Matures at Storrs.
History—Grown in Clintonville for several years.

DENT VARIETIES—*Continued.*

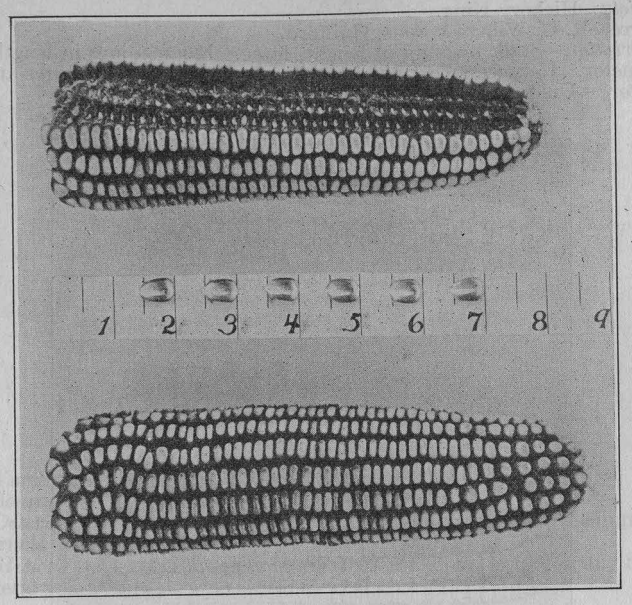

Figure 68.

Variety—Golden Dent.
Source—P. H. Woodford, Avon.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels reddish yellow, deep, medium size, 14-16 rows. Matures at Storrs.
History—Grown for 25 years on Mr. Woodford's farm.

Variety—Hasting's Yellow Dent.
Source—W. S. Hastings, Somers.
Description—Stalk short and small. Ear short and small. Kernels deep yellow, mediumly deep, small, 14-16 rows. Matures very well at Storrs.
History—Mr. Hastings had grown it for several years. He obtained the seed from his brothers in Shelburne, Mass. Brought from West originally.

Variety—Hazenhurst White Cap.
Source—E. Hazen, Haddam.
Description—Stalk tall and large. Ear medium in length, large in diameter. Kernels yellow with white cap, deep, large, 12-16 rows. Requires a favorable season to mature at Storrs.
History—Unknown.

Variety—Herr's Yellow Dent.
Source—W. F. Herr, Brooklyn.
Description—Stalk medium in height, small, ear medium in length, large in diameter. Kernels yellow, medium in depth and size, 14 rows. Matures at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

Variety—Hickory King.
Source—R. C. Wilcox & Sons, Guilford.
Description—Stalk medium in height, large. Ear medium in length, small in diameter. Kernels yellow, shallow, very large, 8 rows. Matures at Storrs.
History—Unknown.

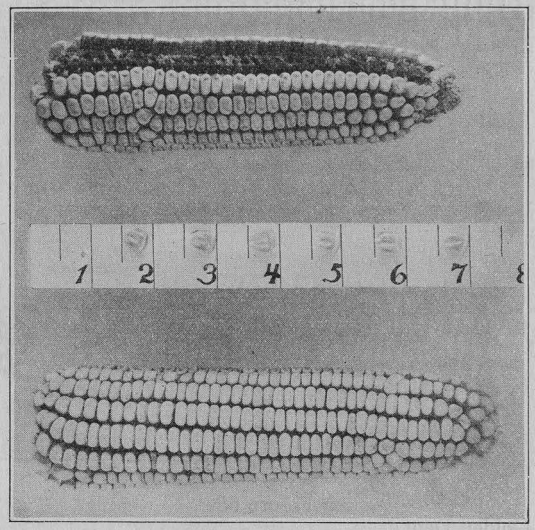

Figure 69.

Variety—Early Huron.
Source—Joseph Harris Company, Coldwater, N. Y.
Description—Stalk short and small. Ear medium in length. Kernels deep yellow, 14-16 rows. Matures well at Storrs.
History—Grown in western New York near Lake Ontario for many years.

Variety—Holcomb's Dent.
Source—P. Holcomb, East Granby.
Description—Stalk medium in height. Kernels yellow, slender 14-18 rows, widely spaced. Matures at Storrs.
History—Grown and seed selected for 20 years by Mr. Holcomb.

Variety—Johnson's Dent.
Source—J. W. Moss, West Cheshire.
Description—Stalk medium in height and large in diameter. Ear long and large. Kernels light yellow, deep, medium in size, 14-16 rows. Does not mature very well at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

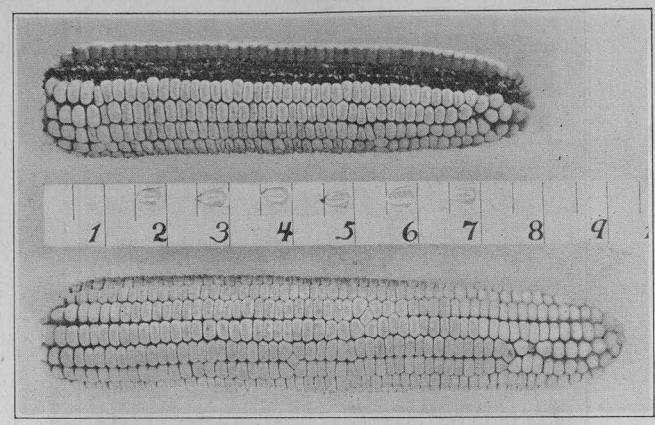

Figure 70.

Variety—Early Huron.
Source—M. H. Williams, Sunderland, Mass.
Description—Stalk medium in height and diameter. Ear medium in length. Kernels deep yellow, 14-16 rows. Matures at Storrs.
History—Result of crossing Early Huron and Pride of North. Selected for several years since.

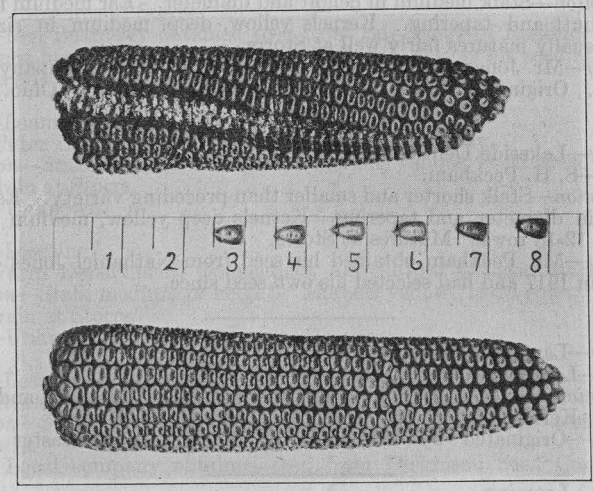

Figure 71.

Variety—Klondyke.
Source—George Hale, Westport.
Description—Stalk tall and large. Ear long and large. Kernels light yellow, 14-16 rows. Does not mature at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

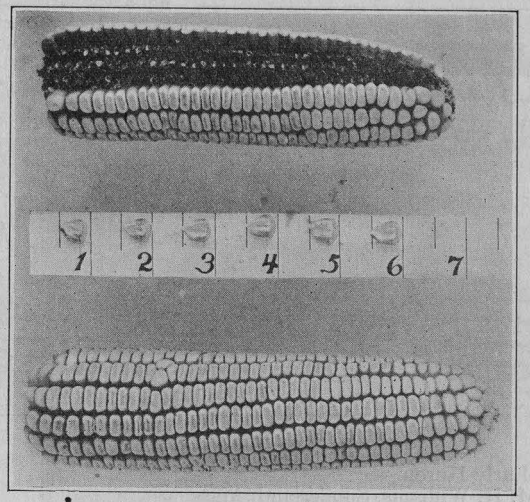

Figure 72.

Variety—Lakeside Dent.
Source—Nathaniel Jones, South Windsor.
Description—Stalk medium in height and diameter. Ear medium in length, large at butt and tapering. Kernels yellow, deep, medium in size, 14-16 rows. Usually matures fairly well at Storrs.
History—Mr. Jones obtained seed from W. F. Cobb & Company, Franklin, Mass. Originally from A. A. Chatfield of Fulton County, Ohio.

Variety—Lakeside Dent.
Source—S. H. Peckham.
Description—Stalk shorter and smaller than preceding variety. Ears short, medium in diameter and tapering. Kernels deep yellow, medium in depth and size, 12-18 rows. Matures at Storrs.
History—Mr. Peckham obtained his seed from Nathaniel Jones of South Windsor in 1917 and had selected his own seed since.

Variety—Lancaster Sure Crop.
Source—Lancaster County, Penn.
Description—Stalk medium in length and diameter. Ears long and slender, tapering. Kernels deep yellow, smooth and broad, 16-20 rows.
History—Originated by Mr. Isaac E. Hershey of Lancaster County, Penna.

Variety—Leaming.
Source—Dibble Seed Company, Honeoye Falls, N. Y.
Description—Stalk of medium height. Kernels yellow, 14-20 rows. Not tested for grain at Storrs.
History—Seed grown at Honeoye Falls, N. Y.

DENT VARIETIES—*Continued.*

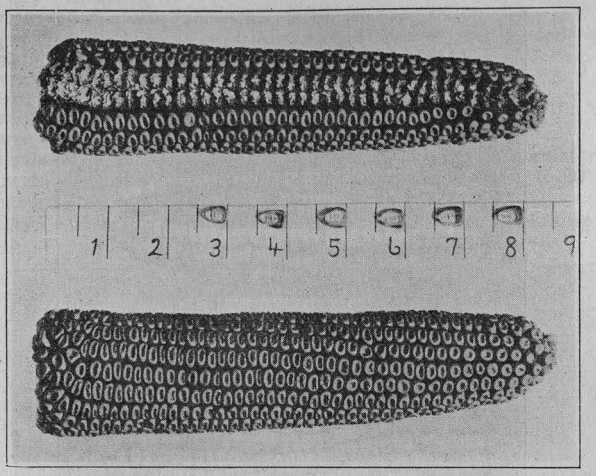

Figure 73

Variety—Leaming.
Source—Heman Beardsley, Roxbury.
Description—Stalk medium in height and diameter. Ear medium in length and diameter, tapering. Kernels dark yellow, medium in depth and size, 16-22 rows. Matures at Storrs.
History—Mr. Beardsley obtained seed from Ed. Seeley of Roxbury about 1905 and since has acclimated it to his conditions. Selects his seed at husking or in the crib.

Variety—Leaming.
Source—Peter Henderson Seed Company, New York City.
Description—Stalk medium in height. Kernels yellow, 14-22 rows. Not tested for grain at Storrs.
History—Unknown.

Variety—Leaming.
Source—Farm Department, Connecticut Agricultural College, Storrs.
Description—Stalk medium in height. Kernels yellow, 14-18 rows. Never tested for grain at Storrs.
History—Unknown.

Variety—Leaming.
Source—Hurley Grant Hardware Company, Willimantic.
Description—Stalk tall and large. Kernels yellow. Never tested for grain at Storrs.
History—Local company obtained seed from Dickinson Seed Company, N. Y. City.

Variety—Leaming.
Source—Thomas Griswold, So. Wethersfield.
Description—Stalk medium in height and diameter. Not tested for grain at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

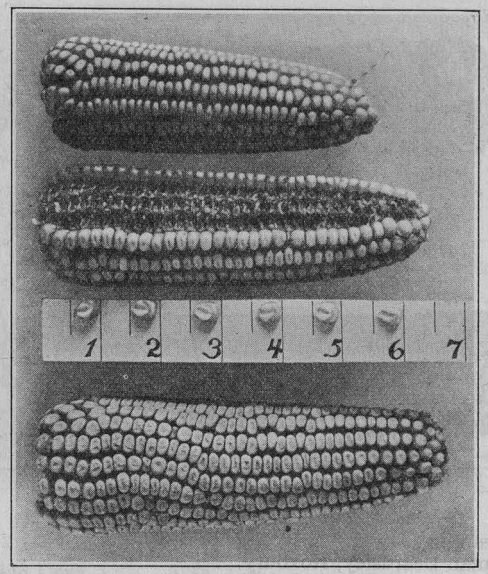

Figure 74.

Variety—Leaming.
Source—L. P. Drake, Harwinton.
Description—Stalk short and small. Ear short and small. Kernels yellow, narrow, very little denting, 12-16 rows. Matures very well at Storrs.
History—Originally from West. Mr. Drake obtained his seed from Chas. Alford of Harwinton about 1900.

Variety—Leaming.
Source—Harrison Hamilton, Ellington.
Description—Stalk medium in height and diameter, Ear medium in length, small. Kernels yellow, medium in depth and size, 12-16 rows. Matures well at Storrs.
History—Mr. Hamilton has grown this variety for several years.

Variety—Leaming.
Source—Ed. Harris, Middletown.
Description—Stalk short and small. Ear medium in length, tapering. Kernels yellow. Not tested for grain at Storrs.
History—Unknown.

Variety—Leaming.
Source—W. A. Lanterman, Fairfield.
Description—Stalk medium in height, large in diameter. Ear medium in length, small in diameter. Kernels deep yellow, shallow, medium in size, 12-14 rows. Matures well at Storrs.
History—Mr. Lanterman has grown this variety for several years and has matured it nicely, even in years of very early frosts.

DENT VARIETIES—*Continued.*

Variety—Leaming.
Source—Feed Store, Norwich.
Description—Stalk tall and large. Kernels yellow. A very late strain of Leaming. Does not mature at Storrs.
History—Unknown.

Variety—Leaming.
Source—F. S. Prince, Xenia, Ohio.
Description—Stalk medium in height and large in diameter. Ear long and large. Kernels light yellow, deep, medium in size, 16-20 rows. Does not mature at Storrs.
History—This is a selected strain of the original Ohio Leaming variety.

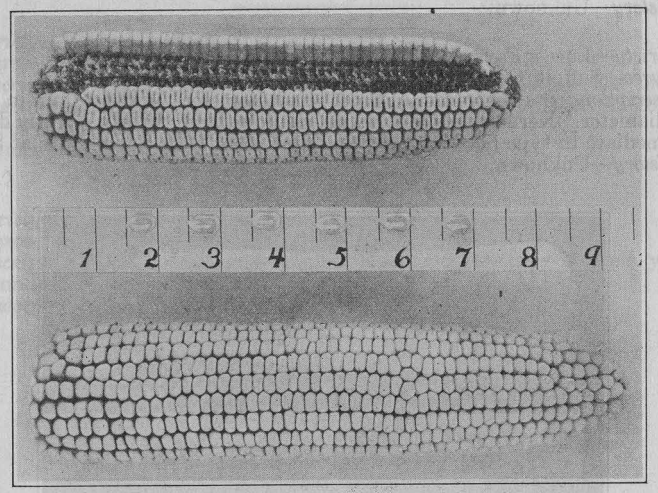

Figure 75.

Variety—Leaming.
Source—W. H. Strong, Avon.
Description—Stalk medium in height, small in diameter. Ear short and small. Kernels yellow, medium in depth and size, 14-16 rows. Matures at Storrs.
History—Mr. Strong obtained seed from Cadwell and Jones of Hartford in 1912.

Variety—Leaming.
Source—Vinehill Farm, Elmwood.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels yellow, medium in depth and size, 12-16 rows. Matures at Storrs.
History—Western Leaming grown about 30 years in Connecticut, carefully selected for ear type from individual plants in the field.

Variety—Leaming.
Source—W. J. Wells, So. Deerfield, Mass.
Description—Stalk medium in height and diameter. Ear rather short. Kernels yellow, 12-16 rows. Matures well at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

Variety—Long Island Dent.
Source—C. E. Salmon, Brooklyn.
Description—Stalk short and small in diameter. Ear medium in length, small. Kernels reddish yellow, shallow, large, 8 rows. Only slightly dented and looks like a flint. Matures well at Storrs.
History—Mr. Salmon brought the seed from Long Island several years ago and has grown it in Brooklyn since. It has now become acclimated.

Variety—Long's Champion.
Source—Whitehorse Farms, Paoli, Pa.
Description—Stalk very tall and very large in diameter. Ear long and very large. Kernels light yellow, 14-22 rows. Does not mature at Storrs.
History—Unknown.

Variety—Luce's Favorite.
Source—Suffolk Cooperative Association, Mattituck, N. Y.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow or white, shallow, large, 8 rows, slightly dented, intermediate in type between dent and flint corn. Does not mature at Storrs.
History—Unknown.

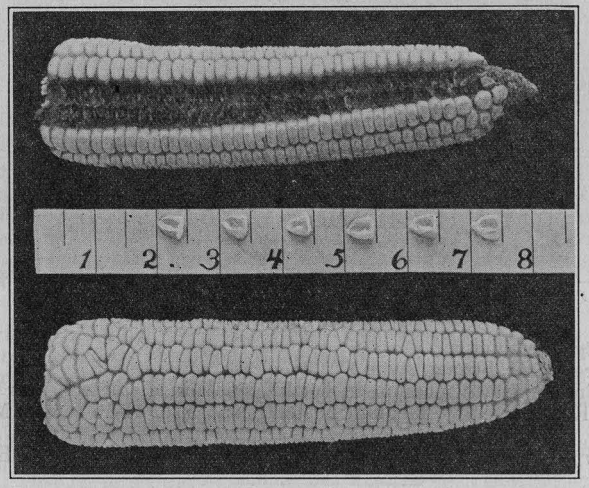

Figure 76.

Variety—Mason's White Dent.
Source—W. W. Chappell, North Franklin.
Description—Stalk short and small. Ear short. Kernels white, 12-16 rows. Matures very well at Storrs.
History—Mr. Mason obtained his seed from N. S. Strong of North Plains about 15 years ago.

Variety—Mastodon.
Source—S. D. Woodruff Seed Company, Orange.
Description—Stalk tall and large. Does not mature at Storrs.
History—Seed obtained each year from Ohio.

DENT VARIETIES—*Continued.*

Variety—Mastodon.
Source—E. G. Packard, Dover, Del.
Description—Stalk very tall and very large. Ear long and very large. Kernels yellow, deep, very large, 18-20 rows. Does not mature at Storrs.
History—Unknown.

Variety—Mastodon.
Source—F. S. Platt Seed Co., New Haven.
Description—Stalk medium in height. Does not mature at Storrs.
History—Seed usually obtained from Ohio.

Variety—Early Michigan.
Source—G. A. Erskine, Guilford.
Description—Stalk medium in height and large in diameter. Ear medium in length, large in diameter. Kernels reddish yellow, deep, large, 12-16 rows. Matures at Storrs.
History—Unknown.

Variety—Minnesota No. 13.
Source—W. A. Stocking & Sons, Weatogue.
Description—Stalk short and small. Ear short, small. Kernels yellow, medium in depth, small, 12-16 rows. Matures very well at Storrs.
History—Grown for 12-15 years in Weatogue.

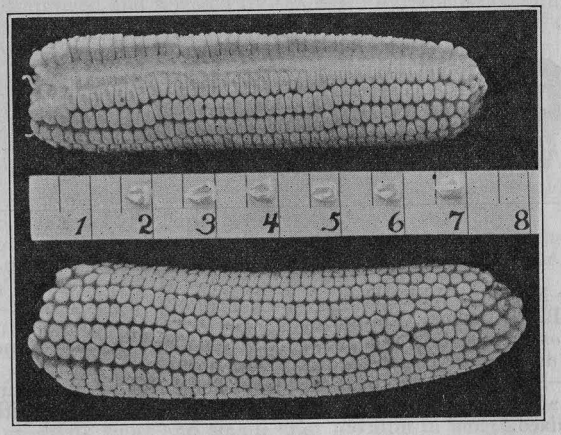

Figure 77.

Variety—Minnesota White Cap.
Source—C. S. Griswold, West Hartford.
Description—Stalk medium in height and diameter. Ear medium in length, cylindrical. Kernels yellow with white caps. 12-16 rows. Matures well at Storrs.
History—Originated from about a dozen stalks found growing in a field of Canada Flint corn about 20 years ago.

DENT VARIETIES—*Continued.*

Variety—Montgomery's White Dent.
Source—Phelps Montgomery, Mt. Carmel.
Description—Stalk medium in height. Kernels white. Does not mature at Storrs.
History—Unknown.

Variety—White Cap Yellow Dent.
Source—N. S. Strong, North Plain.
Description—Stalk medium in height, small in diameter. Ear short and small. Kernels yellow with white caps, medium in depth and size, 12-16 rows. Matures very well at Storrs.
History—Grown in North Plain for 45 years.

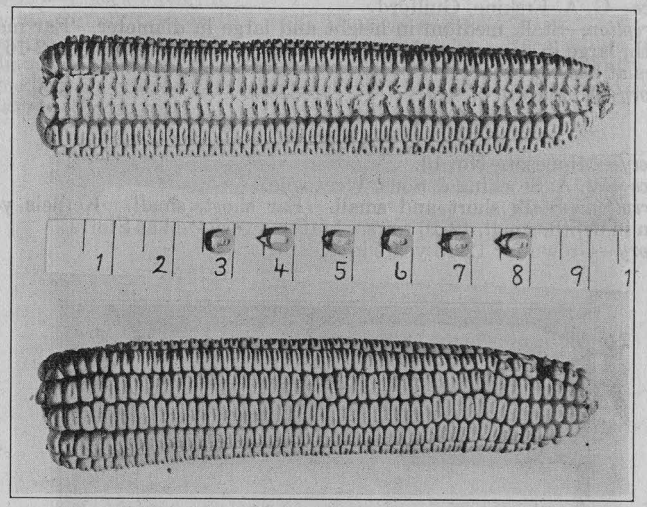

Figure 78.

Variety—Northern White Dent.
Source—B. W. Bishop, Guilford.
Description—Stalk tall and large. Ear long and large. Kernels white, medium in depth, very large, 12 rows. Does not mature at Storrs.
History—Mr. Bishop obtained seed from Peter Henderson Company, New York City about 1905, and grew it near White Hickory King, with which it probably mixed.

Variety—Peck's Yellow Dent.
Source—W. O. Peck, East Haddam.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, medium in depth and size, 14-18 rows. Matures well at Storrs.
History—Mr. Peck obtained seed of a "Connecticut Leaming" in 1916. May be slightly mixed with Brewer's Dent and also with Luce's Favorite.

DENT VARIETIES—*Continued.*

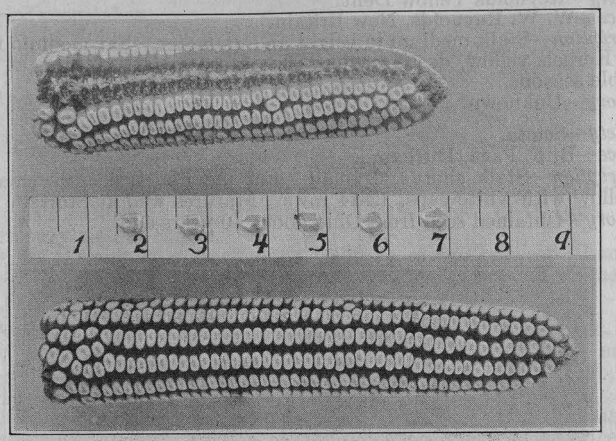

Figure 79.

Variety—Pride of the North.
Source—Storrs Agric. Exper. Station.
Description—Stalk short and small. Ear medium in length and diameter. Kernels yellow, mediumly deep and small, 12-18 rows. Matures well at Storrs.
History—Improved and selected by the late Professor A. G. Gulley of the Connecticut Agricultural College, originally obtained from Ithaca, New York. Grown at Storrs about 15 years.

Variety—Pride of North.
Source—I. N. Hollister, Glastonbury.
Description—Stalk short and small. Ear medium in length. Kernels a variable yellow, 14-16 rows. Matures well at Storrs.
History—Unknown.

Variety—Pride of North.
Source—S. W. and F. A. Kirk, Hamden.
Description—Stalk short and small. Ear short and small. Kernels yellow, medium in depth, small, 16-18 rows. Matures very well at Storrs. Smaller than Storrs' Pride of North.
History—Messrs. Kirk obtained seed from the late Professor Gulley of Storrs in 1910 and have selected since for maximum number of rows of kernels and mature and well filled ears.

Variety—Pride of North.
Source—H. J. Larkham, Norwichtown.
Description—Stalk short and small. Ear medium in length and diameter. Kernels yellow, medium in depth and size, 12-14 rows. Matures well at Storrs.
History—Seed obtained from Thomas Griswold Seed Co., South Wethersfield, Conn.

Variety—Red Cob.
Source—Platt Seed Co., New Haven.
Description—Stalk tall and large. Kernels white. Does not mature at Storrs.
History—Seed obtained from Missouri.

DENT VARIETIES—*Continued.*

Variety—Reynolds Yellow Dent.
Source—W. W. Reynolds, New Britain.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels yellow, deep, medium size, 14-16 rows. Matures at Storrs in favorable seasons.
History—Unknown.

Variety—Sciota.
Source—B. F. Page, Durham.
Description—Stalk short and small. Ear medium in length, small. Kernels yellow with white caps, 12-14 rows. Matures well at Storrs.
History—Obtained seed from Ohio about 40 years ago.

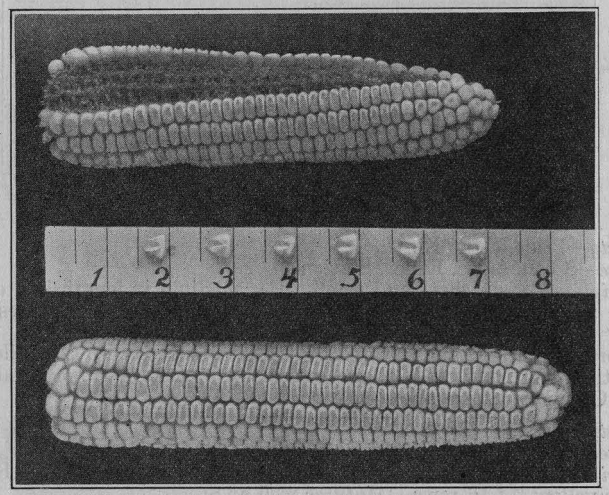

Figure 80.

Variety—Sharon White Cap.
Source—E. K. Dean, Sharon.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow with white caps, medium in depth and size, 12-14 rows, Matures well at Storrs.
History—Brought by C. E. Benton from Michigan about 40 years ago. Generally grown about Sharon.

Variety—Silver King.
Source—Roy McDonald, Menomonie, Wis.
Description—Stalk short and small. Ear short, medium in diameter. Kernels white, deep, small, 16 rows. Matures very well at Storrs.
History—Obtained from Iowa by Wisconsin Experiment Station in 1904 and adapted by ear-to-row selection. Grown at Menomonie about 10 years, selecting the best ears in the field.

Variety—Sutton's Dent.
Source—R. C. Wilcox & Sons, Guilford.
Description—Stalk medium in height and large in diameter. Ear medium in length, very large. Kernels light yellow, deep, large, 14-16 rows. Does not mature very well at Storrs.
History—Obtained from Sutton Seed Co., in Illinois.

DENT VARIETIES—*Continued.*

Variety—Sweepstakes.
Source—S. L. Hollister, Washington.
Description—Stalk tall, medium diameter. Ear medium in length and diameter. Kernels yellow, medium in depth and size, 14-18 rows. Does not mature very well at Storrs.
History—See West Branch Sweepstakes.

Variety—Sweepstakes.
Source—Alex Smith, Clintonville.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels reddish yellow, medium in depth, large, 12-18 rows. Does not mature very well at Storrs.
History—Is a result of a cross made 15-20 years ago between "Lancaster Sure Crop" and a local Pennsylvanian variety. Has been selected since.

Variety—Sweepstakes.
Source—West Branch Seed Growers' Association, Williamsport, Pa.
Description—Stalk medium in height and large in diameter. Ear medium in length and very large. Kernels a variable yellow, mediumly deep, large, 12-20 rows. Does not mature well at Storrs.
History—Is a result of a cross made 15-20 years ago between "Lancaster Sure Crop" and a local Pennsylvanian variety. Has been selected since.

Variety—Sweepstakes.
Source—Clark Seed Company, Milford.
Description—Similar to West Branch Sweepstakes.

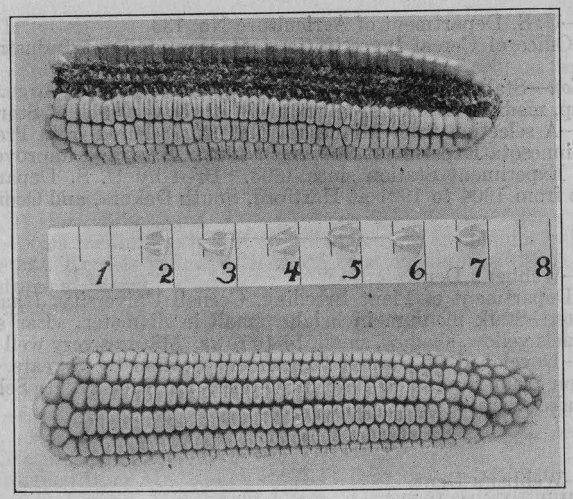

Figure 81.

Variety—Tryon Dent.
Source—J. E. Daniels, Middletown.
Description—Stalk medium in height and small in diameter. Ear medium in length, tapering slightly. Kernels yellow, 12-16 rows. Matures well at Storrs.
History—Originally Dowd Dent. Brought to Middletown from Guilford about 1900 by Willis Tryon and has been grown there since by a few farmers.

DENT VARIETIES—*Continued.*

Variety—U. S. Department of Agriculture No. 119.
Source—Office of Cereal Investigations, Bureau of Plant Industry, Washington, D. C.
Description—Stalk tall and very large. Ear medium in length, very large. Kernels white, deep, large, 14-20 rows. Does not mature at Storrs.
History—A selection from Boone County White, obtained from Marley Riley, Thorntown, Boone County, Indiana. Bred by the U. S. Department of Agriculture since 1903 around Washington, D. C. Boone County White was originated by James Riley, Thorntown, Ind., in 1880.

Variety—U. S. Department of Agriculture No. 125.
Source—Office of Cereal Investigations, Bureau of Plant Industry, Washington, D. C.
Description—Stalk medium in height and large in diameter. Ear medium in length, large in diameter. Kernels yellow, deep, medium in size, 16-20 rows. Matures in very favorable seasons at Storrs.
History—A selection from Clarage, secured from Theodore Giffin at Sabina, Ohio in 1901. Grown and bred by the U. S. Departemnt of Agriculture at Sabina as Sel. 78 from 1901 to 1904. Grown as Sel. 125 at Sunbury, Ohio, 1905 to 1915. For a complete history of Clarage see Ohio Station Circular No. 117, "Varieties of Corn in Ohio."

Variety—U. S. Department of Agriculture No. 133.
Source—Office of Cereal Investigations, Bureau of Plant Industry, Washington.
Description—Stalk short and small. Ear medium in length, large. Kernels yellow, deep, medium in size, 14-18 rows. Matures very well at Storrs.
History—A selection from Minnesota No. 13. Secured from Professor C. P. Bull, Minnesota Experiment Station in 1903. Bred and improved by the Minnesota Experiment Station since 1893. Bred by U. S. Department of Agriculture from 1904 to 1921 at Hartford, South Dakota, and Oconomowoc, Wis.

Variety—Webber's Dent.
Source—Department of Plant Breeding, Cornell University, Ithaca, N. Y.
Description—Stalk medium in height, small in diameter. Ear short and small. Kernels yellow, shallow, small, 14-16 rows. Matures very well at Storrs.
History—Developed at Cornell Experiment Station by 5 years of ear-to-row selection from Funk's 90 Day in co-operation with G. R. Schauber of Ballston Lake, Saratoga Co., New York.

Variety—Webber's Dent.
Source—Willis Frost, Bridgewater.
Description—Stalk medium in height and diameter. Ear medium in length and diameter, tapering slightly. Kernels yellow, deep medium in size, 14-18 rows. Matures fairly well at Storrs.
History—Developed at Cornell Experiment Station by 5 years of ear-to-row selection from Funk's 90 Day in cooperation with G. R. Schauber of Ballston Lake, Saratoga Co., New York. Seed obtained in 1916.

DENT VARIETIES—*Continued.*

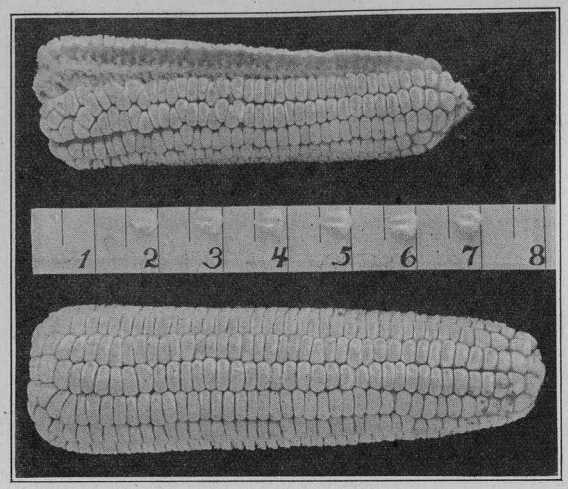

Figure 82.

Variety—White Cap.
Source—G. D. Hall, Wallingford.
Description—Stalk medium in height and diameter. Ear short and tapering. Kernels yellow with white caps, 12-16 rows. Matures at Storrs.
History—Known as Tyler's White Cap and grown around Wallingford for at least 40 years.

Variety—White Cap.
Source—W. F. Herr, Brooklyn.
Description—Stalk medium in height and diameter. Ear medium in length, large in diameter. Kernels yellow with white caps, medium in depth, large, 14 rows. Matures at Storrs.
History—Unknown.

Variety—White Cap.
Source—L. C. Root & Son, Farmington.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow with white caps, medium in depth and size, 14-16 rows. Matures at Storrs.
History—Obtained from Mr. Kelsey in West Hartford about 1910. Originally from Chas E. Lyman, Middlefield, Conn. Grows alternately on Mountain land and low land.

Variety—White Cap.
Source—Joseph Whathley, Kent.
Description—Stalk short and small. Ear medium in length. Kernels yellow with white caps, 12-14 rows. Matures well at Storrs.
History—Unknown.

DENT VARIETIES—*Concluded.*

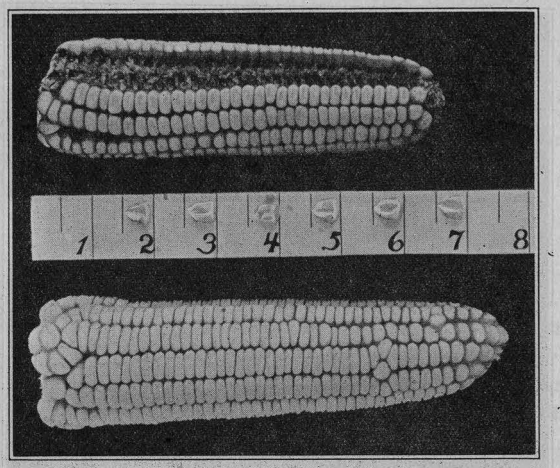

Figure 83.

Variety—White Cap.
Source—Henry Squires, New Milford.
Description—Stalk medium in height and small in diameter. Ear short, small, slightly tapering. Kernels yellow with white caps, 12-14 rows. Matures very well at Storrs.
History—Mr. Squires obtained seed from Sharon 12-15 years ago.

Variety—White Cap.
Source—West Branch Seed Growers' Association, Williamsport, Pa.
Description—Stalk medium in height, large in diameter. Ear long, and large. Kernels yellow with white caps, deep, large, 16-20 rows. Matures at Storrs in favorable seasons.
History—Grown in Pennsylvania for many years.

Variety—Woodford's Dent.
Source—G. C. Woodford, Plainville.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels deep yellow, medium in depth and size, 16-20 rows. Matures fairly well at Storrs.
History—This variety is the result of crossing Early Lakeside on a local dent. Mr. Woodford makes the cross each year.

BULLETIN 260 NOVEMBER, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Rust Infection of Leaves in Petri Dishes

G. P. CLINTON
and
FLORENCE A. McCORMICK

BOTANICAL DEPARTMENT

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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November, 1924.

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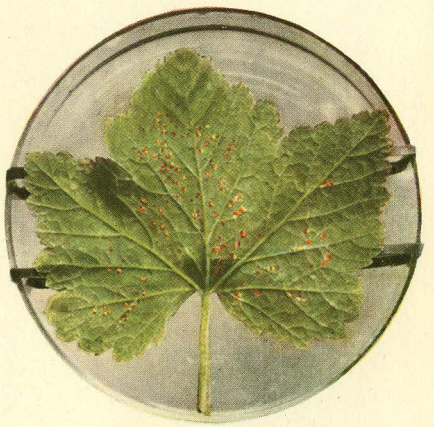
a. II stage of *Phragmidium Potentillae* on *Potentilla canadensis*, Inf. No. 1014a II.

b. III stage of *Gymnoconia interstitialis* on *Rubus villosus*, Inf. No. 959.

c. O stage of *Gymnosporangium Juniperi-virginianae* on *Pyrus Malus*, Inf. No. 937.



d. II stage of *Cronartium ribicola* on *Ribes vulgare*, Inf. No. 764.

ARTIFICIAL INFECTIONS OF RUSTS IN PETRI DISHES.

Rust Infection of Leaves in Petri Dishes.*

G. P. Clinton and Florence A. McCormick.

HISTORICAL.

On May 21, 1918, the writers placed aeciospores (Inf. No. 298) of *Cronartium ribicola* from *Pinus Strobus* on leaves of *Ribes nigrum* in a Petri dish in the hope of determining the method by which the germ tubes entered the leaves. Within twenty-four hours it was found that they had gained entrance into the leaves through the stomates and the dish was set aside for later examination to see if further development took place. About ten days after inoculation examination showed, much to our delight, numerous mature uredinia. Similar inoculations made a day or two later showed about this time even more abundant infections, in fact better than those obtained on living plants.

These results encouraged us in the belief that this method of inoculation might possess advantages superior to that with living plants in the greenhouse; consequently more inoculations were made on a variety of *Ribes* leaves in Petri dishes. Fair success attended these experiments although the inoculating material used was not very good. Improvement of the methods used and comparison of Petri dish versus pot infections, made under similar conditions and at various times, finally led us to the conclusion that the Petri dish method gave results on the whole equal to the pot method and had several distinct advantages in simplicity of operation.

Literature. The writers made brief mention of this method in Bull. 2, White Pine Blister Rust Control, p. 14, published by the American Plant Pest Committee in 1918 and in publications of this Station (Bull. 214, pp. 437, 440, and Bull. 222, p. 471.) in 1919 and 1920.

So far as we know no other writers have published statements concerning successful production of rust sori on leaves in Petri dishes, though somewhat similar experiments have been published by various workers. For instance Farlow (American Acad. Arts & Sci. **20**: 311.) in 1885, working with five species of *Gymnosporangium*, produced pycnia on detached leaves of *Crataegus* and *Amelanchier* with three of the species under the conditions quoted as follows: "The leaves (Pomaceæ) were placed on moistened glass slides and arranged on zinc stands under bell-glasses. The sporidia

* This paper was largely written in the spring of 1921 when other work prevented its completion. It has now been brought up to date including the inoculations made since then. We are indebted to E. M. Stoddard of this department for the photographs used.

were then carefully dropped upon the leaves, which were immediately covered by a bell-glass. The leaves under each glass were sown with the sporidia of but one species, the bell-glasses were removed for a moment only, and at no time were the leaves under more than one bell-glass exposed. I also used a number of small seedlings of Pomaceæ, each pot being covered by a glass receiver."

Ward (Proc. Roy. Soc. Lond. **69**: 451.) in 1902 described a unique method for growing grass seedlings in large special test tubes where pure cultures of rusts were grown on them while thus protected. His method is best described by the following extracts from his paper: "In order to obtain more decisive answers to such questions as—Are any of the results obtained on plants in the open or merely covered with bell-jars and so forth, due to spores accidentally introduced, or to mycelium, etc., already in the plant? —a number of infections were made on seedlings germinated and grown antiseptically in tubes as follows * * * * Clean picked seeds were placed singly, by means of forceps, on filter paper at the bottom of Petri dishes properly sterilized by heat. When these had germinated and observation showed that the whole series was free of moulds or other signs of contaminations, the seedlings were removed by means of sterile forceps, and transplanted singly into sterilized tubes of various kinds as described below, and the further growth allowed to proceed in the light under conditions varied as will be seen * * * * Preliminary experiments soon showed that the Brome seedlings thus raised from seeds treated antiseptically and protected from the first by glass, may be grown for weeks and even for a couple of months in such tubes under proper precautions, and I set myself the task of ascertaining how such cultures would behave in infection experiments. * * * * This experiment is interesting not only as showing that plants can be grown and infected successfully in these closed water-cultures, but especially as showing the contrast between the aerated and non-aerated tubes, for since the infected seedlings were selected in each case from the same Petri dish cultures, we must assume that the difference in rate of development was due to the difference of ventilation, and perhaps conclude that this interferes with the success of the parasite, as measured by the somewhat longer inoculation period. It is remarkable how dwarfed the continuously aerated plants are, compared with those in the closed tubes, owing to the elongation of the leaves of the latter. It is clear, therefore, that pure cultures of Uredo-spores can be obtained by this method, and it is equally clear that we can also obtain pure cultures of the host-plants, and since we can do this, there is no reason why the infection of Uredineae should not be conducted as vigorously and exactly as that of bacteria."

Coons (Ann. Rep. Agr. Exp. Sta. Neb. **25**: 222.) in 1912 made inoculations in Petri dishes with *Gymnosporangium Juniperi-virginianae* on apple leaves to determine the method of entrance of the germ tubes. Evidently he did not save the inoculations long enough to observe further development. We make the following quotation from his article: "With the microscope it was possible to see the hyphae from the sporidia after a vagrant tortuous growth in the water, bend sharply downward at the edge of the drop and pass into the cells beneath. This last observation was made with leaves washed in sterile water and kept in Petri dishes. These were inoculated in drops of water and marked by circles with the cork borer."

The Petri dish method of infection with fungi other than rusts has been tried by various experimenters as shown by the two following references. Salmon (Journ. Bot. **41**: 212.) in 1903 described his methods with the powdery mildews in these words: "The following method of culture for infection experiments has been adopted. The leaves to be inoculated are cut off from the plant and placed on wet filter paper at the bottom of a Petri dish, the under surface of the leaf being everywhere pressed into contact with the wet filter-paper. If the experiment is to be continued for more than a week or ten days, a seedling with the first leaf attached to the seed must be used. The Petri dishes can be placed in circular dishes of about the same depth and of a half-inch greater diameter and the intervening space at the sides stuffed with cotton-wool. This will remove all danger of infection from foreign spores after the experiment has been set up."

In 1916 very similar methods were used by Blackman and Welsford (Ann. Bot. **30**: 390.) in infection work with *Botrytis cinerea* described as follows: "Before infection the leaves are washed with a gentle stream of sterile distilled water to remove as far as possible extraneous spores and dust. They are then placed on damp filter-paper on a sterile Petri dish, and drops of the prepared solution containing spores placed on their upper surfaces."

The writers were not aware of the methods of the preceding investigators when their work was first undertaken. The results we obtained, however, with *Cronartium ribicola* were such as to justify us in extending the experiments to various other rusts. These experiments have now been carried on over seven seasons. The number of hosts thus infected with various species has exceeded our expectations. The improvement of our methods through experience enabled us to keep leaves alive much longer than at first and thereby successful inoculation was increased. It is deemed advisable to make a more detailed record here of our methods, with the results obtained, in order that they may be used by others, since our experience has shown decided advantages with this method especially with rusts which inhabit the less succulent and ephemeral leaves.

METHODS.

Petri dish versus pot method. Soon after finding that successful inoculation of *Ribes nigrum* could be made in Petri dishes with blister rust, it was decided to carry on a series of tests with different species of *Ribes* in Petri dishes as well as in pots. Tests were made with both I and II stages. In Table I is given a summary of all our experiments with these stages in Petri dishes and pots, regardless of whether they were made under similar conditions or not. This shows that with the I stage out of one hundred and seventy tests made in Petri dishes 66% were successful and according to our grade of marking these were rated poor (+), while of the one hundred and twenty-three tests made in pots 78% were successful with an average of fair (−). These tests favor somewhat the pot method, especially as regards percentage of infection. In this case it is to be remembered, however, that many more leaves were exposed to infection. In the tests with the II stage, where the amount of uredospores and number of leaves inoculated were more nearly alike, because of the difficulty of obtaining an abundance of the spores, the results were about the same. In this case in one hundred and sixty-nine tests in Petri dishes 57% were successful with an average rating of poor (+), while of the fifty-six tests in the pots 57% were successful with an average rating of fair (−).

Several comparative tests were made with the I stage on leaves in Petri dishes and plants in pots, with the other conditions as nearly alike as possible, on twenty-four species and varieties of *Ribes*. While these gave somewhat different results on certain of the hosts, sometimes in favor of the Petri dish and again in favor of the pot, the average result for the lot was about the same from each method, favoring slightly the pot. We concluded at the time, taking into consideration the amount of inoculating material and the number of leaves used, that one method was as successful as the other. We were not able to make similar comparisons with other rusts but our general experience with those inhabiting leaves of shrubs and trees is that the Petri dish method has certain advantages.

Technique. Where a considerable number of inoculations is to be made, Petri dishes of about 100 mm. in diameter and 15 mm. deep are a convenient size to use. A larger size is even more desirable, especially when few are required. Our usual method has been to stretch two well-washed rubber bands loosely across the bottom of the sterilized dish, and on these is placed the wet leaf or leaves. When the cover is inserted the leaves should be near the top but not touching it. Our most recent method has been to file four opposite or equally distant notches, about a quarter of an inch deep, in the edge of the bottom dish and stretch the rubber bands across and diagonally through these to hold the

leaves out of the water below but free from pressure above. (See Plate XXVIa.) Glass rods with a flat surface below can be used in place of the rubber bands. These, however, should be of sufficient height to elevate the leaf above the water and near to the cover. A small amount of water is poured in the bottom of the dish. The spores are dusted or brushed off the inoculating material over the exposed surface of the leaf. In case the I and II stages are used it is better to place the lower surface of the leaf uppermost, since infection usually takes place through the stomates which are more abundant on that surface; also the sori that result in such cases usually break out on the lower surface and consequently can be watched carefully without disturbing the leaf or removing the cover. In case the inoculation is with the III stage, where infection generally takes place by direct penetration of the epidermis, it is better to place the upper surface of the leaf uppermost, as this is freer from hairs which hinder infection. Furthermore the pycnial stage is more likely to appear on this surface and it is difficult to carry the infection beyond this stage because of the length of time required. The Petri dish should be placed where it receives direct light favorable for plant growth. North light or direct sunlight partially screened by thin white paper or a coating on the windows is desirable. The conditions upon which infection is successful depend largely upon the following factors—leaves, moisture, light and heat.

Leaves. The leaves must remain in fairly healthy condition from seven to ten days and in some cases more than two weeks after inoculation. Leaves of different plants vary greatly in this respect. As a rule the hardier leaves of shrubs and trees do not succumb as quickly as those of herbaceous plants. Again with some plants, as the grasses, it is often impossible to place the whole leaf in the Petri dish because of its size and mutilation is more or less harmful. Enzymatic or other changes in certain leaves frequently kill them before infection is apparent, but the chief difficulty seems to be with molds that cause decay. This last injury can be reduced or delayed by very thorough washing of both sides of the leaves in running tap water. The wet leaf is then placed in the Petri dish. Partial sterilization did not give so effective results as the washing in water alone. This is a matter, however, that may need further investigation. It is taken for granted that in the selection of leaves only those in the best condition, and, where possible, of a size smaller than the Petri dish will be selected; also that they are free from natural infection.

Moisture. The moisture in the bottom of the Petri dish is sufficient to keep the air fairly well saturated. Considerable moisture becomes condensed on the cover in close proximity to the inoculated surface of the leaf, thereby making conditions for spore germination very favorable. It is necessary from time to time to renew the water in the bottom of the dish as it is lost by

evaporation. This may be added by pouring it in the dish or by spraying it over the leaves, as conditions warrant. The dish should never be allowed to become entirely dry as the leaves will wither and die in a very short time. On the other hand the amount of water should not be sufficient to touch the leaf blade in the handling that is necessary. In our work different methods were tried, such as a small film or an abundance of water with the leaf directly on it. The method described, however, seemed to possess the most merits in securing abundance of infection and freedom from molds.

Light. In the first experiments the Petri dishes were left in the diffused light of the culture room some distance from the window. Trouble with molds suggested that better results might be obtained with direct light. Comparative tests were then made both with inoculated and uninoculated leaves left in the culture room and others placed in the small laboratory greenhouse having an eastern exposure but with the light cut off from the south and west. To lessen the strong sunlight of summer the glass was shaded by paper. These tests were in favor of the direct light so that practically all of our infections have been made in this greenhouse. Our opinion is that the latter place is more favorable for the following reasons. First, the direct light on the leaves seems to keep them in healthier condition so that molds are not so troublesome as in subdued light. Second, this action on the chloroplasts favors the normal photosynthetic processes which furnish food for the leaf and thereby favor the more vigorous development of the fungus. If it were not for the ease of examination, etc., it would probably be better in all cases to expose the upper surface of the leaf to the light thereby securing full benefit from it as in nature.

It is surprising how long some leaves remain healthy under these optimum conditions. Not infrequently we have kept leaves green and alive for three or four weeks. In exceptional cases where a callus has formed at the base of the petiole, they have remained alive even longer. In one case a *Rubus* leaf, where a callus had formed and rootlets developed, remained alive for a couple of months. Plate XXVIb shows a black currant leaf about a month after it was placed in a Petri dish developing a secondary callus at one side of the primary one. This leaf was just beginning to die when photographed. Plate XXVId shows one of several leaves of *Solidago rugosa* that remained alive and green three months in the Petri dishes developing from the calluses formed at their bases branched rootlets one to two times the length of the leaves. These leaves were then placed in sand and later earth added in the hope that they might develop buds and new plants and were still healthy and green after four months. Either the addition of the earth or accidental drying out caused their death soon afterward. However, one had formed a minute plantlet on a root or runner developed from the callus. These examples are, of course, exceptional but in case a callus develops longer life is assured. Whether coating the end of the petiole with melted paraffin would favor callus formation has not been determined.

Heat. It has been shown with the rusts, as with other fungi, that spores germinate best at certain temperatures known as their optimum and that maximum temperatures also exist beyond which germination ceases to take place. Doran (Phytopath. **9**: 391–402. S. 1919.) worked with several of the rusts along this line and he found that for the aeciospores of *Cronartium ribicola* the optimum temperature was 12°C and the maximum 19°C and the uredospores had an optimum temperature of two degrees and a maximum of six degrees higher than those of the aeciospores. In our experiments the ordinary room temperature of the greenhouse in spring and fall seemed favorable. In mid-summer, however, the temperature reached such a height that practically all the cultures died out. To obviate this difficulty a modification of Hunt's (Phytopath. **9**: 211–12. My. 1919.) iceless refrigerator was used. This on the whole kept the temperature down on an average only a few degrees, but it was sufficient to favor the cultures over those outside. However, the cloth cut down the light so that this was not so favorable. A cold incubator with glass sides which can be kept in the sunlight at a desired temperature would be a very valuable adjunct for summer inoculations.

GENERAL RESULTS.

Advantages and disadvantages of method. We will first mention the one disadvantage of the Petri dish method, the early death of the leaves. This happens more quickly with some leaves than with others as has already been mentioned. With *Cronartium ribicola* on *Ribes* it was only an occasional disadvantage as most of the leaves lived long enough to produce mature sori of uredinial and occasionally of telial stages. With such tender leaves as clovers, however, death of the leaves often occurred too early to secure definite results. With *Pyrus* the leaves usually lived long enough to secure pycnia but not long enough to produce aecia. A combination of this method with Ward's, using the latter for grasses and quick growing seedlings, will probably solve the problem for infection of most hosts. No doubt some may be disappointed with their first results of the Petri dish method, as experience is an important factor in obtaining success.

The advantages must be evident to anyone who stops to consider the matter. First, we mention compactness. Petri dishes occupy little space and by means of glass or wire shelves many can be used in a small area. Ordinarily we have used them on glass shelves in the iceless refrigerator or on a cement greenhouse bench containing sand which has been covered with botanical driers soaked in corrosive sublimate to prevent molding. The

second advantage is economy of material. Often one plant will furnish enough leaves for many experiments whereas if the pot method is used the whole plant is involved. A third advantage is ease and exactness of observation. With a leafy plant of some size the first appearance of the sori may escape observation. These can be observed through the Petri dish cover very easily and quickly. By this method we have found uredinial sori within six days and twenty-two hours after inoculation. This is earlier than we have ever found them on plants in pots. A fourth advantage is the surety of pure cultures since there is little danger, compared with plants in pots, of spores of other rusts reaching the inoculated leaves. Better control of moisture for securing germination of spores is another advantage.

Rusts used in the experiments. Altogether thirteen different genera of rusts were experimented with, as follows: *Caeoma, Coleosporium, Cronartium, Gymnoconia, Gymnosporangium, Kuehneola, Melampsora, Melampsoridium, Melampsoropsis, Phragmidium, Puccinia, Pucciniastrum* and *Uromyces*. We were successful in producing one or more infections with all of these excepting the first. Under these genera forty-five different species were used and successful inoculations were secured with all but seventeen. Many different hosts were inoculated with these. Some of these failures were due to the use of the wrong host. In other cases failure was due to poor inoculating material. It is quite probable that in some tests the leaves died before the sori had time to develop. The most extended experiments were with *Cronartium ribicola* involving three hundred and thirty-nine tests on thirty-eight different species and varieties. Tests were made with all spore stages, O, I, II and III. No results were obtained with the O stage, as was to be expected. Most inoculations were made with the I and II stages. No new relationships between supposedly distinct species were found. Several new hosts, however, were secured through inoculations and a few old hosts are reported for the first time experimentally.

In interpreting the results of the inoculations we have used the following terms: failed, poor, fair, good and excellent. These, except the first, have been used in a general rather than in an exact sense. Usually the number of sori occurring has indicated the class. With the pot experiments, however, the number of infected leaves as well as the number of sori was taken into consideration. The amount of inoculating material used, especially the II stage, was also a factor in grading. As a rule poor indicates that fewer than five sori developed. Excellent implies the development of forty or more on a leaf or leaves in a Petri dish and an even greater total number on the leaves of a plant in a pot. Good and fair are intermediate terms. The inoculation number and date, as well as source of inoculating material and host inoculated, are given with each experiment. The details of the experiments both successful and unsuccessful are given in the following pages.

DETAILS OF INOCULATIONS AND INFECTIONS.

Caeoma nitens Schw.

None of the inoculations made with this short cycled form was successful. Comparison should be made with similar successful inoculations with the long cycled form given here under *Gymnoconia interstitialis*. We thought at one time that possibly this short cycled form was the *Caeoma* stage of some other rust, most likely *Melampsora*, but our failures to inoculate the various species of *Populus, Salix* and *Betula* discredit this supposition. Likewise the failure to inoculate mature leaves of *Rubus* species has led us finally to believe that infection takes place with this short cycled form only through the young tissues especially the underground shoots. See articles in Bull. 222, p. 469, of this Station.

O stage from *Rubus villosus* (*R. canadensis*): on *R. villosus*, 894 (upper surface), 895 (lower surface), 896 (cut surface), My. 27, '19, failed.

I stage from *Rubus allegheniensis* (*R. villosus*): on *R. allegheniensis*, 1349 (wild), 1353 (Erie), 1355 (Snyder), Je. 22, '20, failed: on *R. villosus*, 1347, Je. 22, '20, failed: on *R. occidentalis*, 1345, 1351, Je. 22, '20, failed.

I stage from *Rubus villosus:* on *Betula lenta*, 904, 911, 918, My. 27, '19, failed: on *B. populifolia*, 903, 910, 917, My. 27, '19, failed: on *Populus deltoides*, 907, 914, 921, My. 27, '19, failed: on *P. grandidentata*, 901, 908, 915, My. 27, '19, failed: on *P. tremuloides*, 902, 909, 916, My. 27, '19, failed: on *Populus* sp., 363, Je. 22, '18, failed: on *Rubus hispidus*, 4336, Je. 15, '23, failed; 4351, Je. 20, '23, failed: on *R. villosus*, 332, 333, 334, 335, Je. 6, '18, failed; 958, Je. 11, '19, failed; 4004, Je. 15, '22, failed; 4289, 4292, Je. 1, '23, failed; 4327, Je. 12, '23, failed; 4337, Je. 15, '23, failed; 4344, Je. 16, '23, failed; 4349, Je. 20, '23, failed; 4579, 4582, Jl. 2, '24, failed: on *Rubus* sp. (cult. blackberry), 4007, Je. 15, '22, failed; 4288, 4291, Je. 1, '23, failed; 4328, Je. 12, '23, failed; 4350, Je. 20, '23, failed; on *Rubus* sps., (wild and cult. raspberry), 4005, 4006, Je. 15, '22, failed; 4290, 4293, Je. 1, '23, failed: on *Salix* sps., 905, 906, 912, 913, 919, 920, My. 27, '19, failed.

Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long.

The successful inoculation, on *Solidago graminifolia Nuttallii*, was with the host on which the II and III stages of this rust most commonly occur in this state. The senior writer in years previous had also inoculated the same host in crock experiments. One out of four inoculations was successful as follows:

I stage from *Pinus rigida:* on *Aster* sps., 807, 808, My. 19, '19, failed: on *Solidago graminifolia Nuttallii*, 814, My. 20, '19, fair, II: on *S. rugosa*, 806, My. 19, '19, failed.

Coleosporium Solidaginis (Schw.) Thuem.

Inoculations of the I stage from *Pinus rigida* were successful on *Solidago rugosa, S. sempervirens*, and of the II stage from *Solidago* sp. on *Solidago* sp. and *S. rugosa*. Five out of twelve inoculations, or 42%, were successful as follows:

I stage from *Pinus rigida:* on *Solidago rugosa,* 933, Je. 4, '19, good, II; 1344, Je. 17, '20, excellent, II; 4568, Je. 11, '24, poor, II: on *Solidago sempervirens,* 893, My. 26, '19, poor, II.

II stage from *Solidago rugosa:* on *Aster laevis,* 579, O. 5, '18, failed: on *Solidago rugosa,* 578, O. 5, '18, failed; 1115, O. 27, '19, failed.

II stage from *Solidago* sp.: on *Aster laevis,* 1021, Jl. 19, '19, failed: on *Aster* sp., 1522, O. 28, '20, failed: on *Solidago graminifolia Nuttallii,* 1019, Jl. 19, '19, failed: on *S. rugosa,* 1020, Jl. 19, '19, failed; 1521, O. 28, '20, poor, II: on *Solidago* sp., 1022, Jl. 19, '19, fair, II.

Cronartium Comptoniae Arth.

Successful inoculations on *Myrica asplenifolia* were made with the I stage from the five species of *Pinus* tried. The inoculations with the III stage on the pines probably failed, at least nothing definite showed to the naked eye. Our inoculations of plants in crocks, however, showed that there is very little visible sign of successful inoculation. At one time the *Cronartiums* were classed together under *C. asclepiadeum* but our unsuccessful attempts to inoculate *Ribes* and *Quercus* add weight to the belief that the rusts on these two hosts and *Myrica* are distinct species as now regarded. The details of the inoculations follow:

I stage from *Pinus austriaca:* on *Myrica* (*Comptonia*) *asplenifolia,* 4556, My. 28, '24, excellent, II.

I stage from *Pinus montana Mugho:* on *Myrica asplenifolia,* 4285, My. 31, '23, excellent, II; 4566, Je. 10, '24, excellent, II. See Plate XXVIa.

I stage from *Pinus ponderosa:* on *Myrica asplenifolia,* 4286, My. 31, '23, excellent, II.

I stage from *Pinus rigida:* on *Myrica asplenifolia,* 342, Je. 6, '18, good, II: on *Ribes nigrum,* 899, My. 27, '19, failed.

I stage from *Pinus sylvestris:* on *Myrica asplenifolia,* 340, Je. 6, '18, good, II: on *Ribes nigrum,* 302, My. 27, '18, failed: on *R. vulgare,* 301, My. 27, '18, failed: on *Quercus alba,* 341, Je. 6., '18, failed.

III stage from *Myrica asplenifolia:* on *Pinus austriaca,* 1079, S. 15, '19, (?) failed: on *P. sylvestris,* 1078, S. 15, '19, (?) failed.

Cronartium occidentale Hedgc., Beth. & Hunt.

The inoculations with the I stage from *Pinus monophylla* were all made on May 28, 1920 and were successful on the following hosts: *Ribes americanum, R. aureum, R. aureum chrysococcum, R. Cynosbati, R. divaricatum, R. Grossularia* (*uva-crispa*), *R. hirtellum, R. intermedium, R. nigrum, R. nigrum aconitifolium, R. odoratum, R. oxyacanthoides, R. robustum,* and *Ribes* sps. (cult. gooseberries). Several were apparently new hosts for this rust. The inoculations were in triplicate, the average results being given. We are indebted to Bethel and others of the U. S. Department of Agriculture for the inoculating material used.

I stage from *Pinus monophylla:* on *Ribes alpestre,* 1270, failed: on *R. alpinum* ♂, 1285, failed: on *R. americanum,* 1273, poor, II, III: on *R. aureum,* 1267, good, II, III: on *R. caucasicum,* 1269, failed: on *R. aureum chrysococcum,* 1276, excellent, II: on *R. curvatum,* 1271, failed: on *R. Cynosbati,* 1275, good, II, III: on *R. divaricatum,* 1272, fair, II:

on *R. Grossularia* (*uva-crispa*), 1289, fair, II, III: on *R. giraldii,* 1268, failed: on *R. hirtellum,* 1281, fair, II: on *R. holosericeum,* 1284, failed: on *R. intermedium,* 1278, fair, III: on *R. luridum,* 1280, failed: on *R. nigrum,* 1279, poor, II: on *R. nigrum aconitifolium,* 1287, poor, II: on *R. odoratum,* 1290, good, II: on *R. oxyacanthoides,* 1291, good, II, III: on *R. robustum,* 1277, poor, II: on *R. stenocarpum,* 1288, failed: on *R. vulgare* (Fay's Prolific), 1274, failed; 1283 (small currant), failed; 1282, (white currant), failed: *Ribes* sps. (large cult. gooseberry), 1286, poor, II; 1292 (Smith's small gooseberry), poor, II, III.

II stage from *Ribes aureum chrysococcum* (in Petri dish): on *Ribes aureum chrysococcum,* 1276 (2), Je. 17, '20, failed.

II stage from *Ribes gracillimum*: on *R. americanum,* 4403, Jl. 14, '23, failed: on *R. aureum,* 4404, Jl. 14, '23, failed: on *R. nigrum,* 4402, Jl. 14, '23, failed.

Cronartium ribicola Fisch. de Waldh.

Inoculations with I stage from *Pinus Strobus.* In the experiments with the I stage thirty-eight species and varieties of *Ribes* were used and one hundred and seventy-two inoculations made. Of these one hundred and six, or 62%, were successful, despite using old spores and inoculating the upper surface in a number of cases. *Ribes nigrum,* with twenty-seven tests of which nearly 78% produced infection, and *Ribes oxyacanthoides,* with eight inoculations and 87% of infection, gave the best results. The following species also became infected: *R. alpinum* ♀, *R. americanum, R. aureum, R. aureum chrysococcum, R. caucasicum, R. Cynosbati, R. Cynosbati inerme, R. diacantha, R. divaricatum, R. fasciculatum chinense, R. Grossularia* (*uva-crispa*), *R. hirtellum, R. holosericeum, R. intermedium, R. longiflorum, R. luridum, R. nigrum aconitifolium, R. odoratum, R. robustum, R. vulgare, R. vulgare* (Fay's Prolific), *R. vulgare* (Small Currant), *R. vulgare* (White Currant), *Ribes* sp. (large gooseberry) and *Ribes* sp. (Smith's Small gooseberry). We are indebted to the Arnold Arboretum for most of the species of *Ribes* used in these and the other inoculations.

Uniform failure to infect leaves when spores were placed on the upper surface, where there are few or no stomates, proves infection takes place only through these, as is also shown by actual observation. It is interesting, also, to note that good infection took place with spores 35 days old and poor with those 49 days old (*i. e.,* that long after the branches containing the aecial spores were cut from the tree and left in the laboratory.)

I stage from *Pinus Strobus:* on *Ribes alpestre,* 685, Ap. 28, '19, failed; 787, My. 13, '19, failed; 1313, My. 29, '20, failed: on *R. alpinum* ♀, 687, Ap. 28, '19, failed; 792, My. 13, '19, poor, II, III: on *R. alpinum* ♂, 312, Je. 4, '18, failed; 777, My. 13, '19, failed; 886, My. 22, '19, failed; 929, Je. 4, '19, failed; 1294, My. 29, '20, failed: on *R. americanum,* 304, 309, Je. 4, '18, poor, II; 707, Ap. 28, '19, fair, II; 715, Ap. 28, '19, good, II; 726, My. 2, '19, failed (upper surface); 762, My. 13, '19, failed; 783, My. 13, '19, fair, II; 1315, My. 29, '20, poor, II; 1331, Je. 3, '20, failed?: on *R. aureum,* 313, Je. 4, '18, failed; 671, Ap. 28, '19, failed; 725, My. 2, '19, failed (upper surface); 779, My. 13, '19, failed; 1319, My. 29, '20, fair, II: on *R. aureum chrysococcum,* 305, Je. 4, '18, poor, II; 778, My. 13,

'19, fair, II; 888, My. 22, '19, failed; 932, Je. 4, '19, failed; 1305, My. 29, '20, fair, II: on *R. caucasicum*, 306, Je. 4, '18, fair, II; 697, Ap. 28, '19, fair, II; 782, My. 13, '19, fair, II; 1314, My. 29, '20, poor, II: on *R. curvatum*, 786, My. 13, '19, failed; 885, My. 22, '19, failed; 1301, My. 29, '20, failed: on *R. Cynosbati*, 789, My. 13, '19, fair, II; 1317, My. 29, '20, good, II: on *R. Cynosbati inerme*, 770, My. 13, '19, fair, II: on *R. diacantha*, 689, Ap. 28, '19, fair, II: on *R. divaricatum*, 324, Je. 4, '18, fair, II; 679, Ap. 28, '19, good, II; 727, My. 2, '19, failed (inoc. on upper surface); 758, My. 13, '19, fair, II; 1306, My. 29, '20, fair, II: on *R. fasciculatum chinense*, 699, Ap. 28, '19, fair, II; 795, My. 13, '19, poor, II: on *R. Grossularia*, 303, Je. 4, '18, failed; 693, Ap. 28, '19, failed: on *R. Grossularia (uva-crispa)*, 772, My. 13, '19, fair, II; 1296, My. 29, '20, fair, II: on *R. giraldii*, 695, Ap. 28, '19, failed; 729, My. 2, '19, failed (inoc. on upper surface); 785, 791, My. 13, '19, failed; 887, My. 22, '19, failed; 1310, My. 29, '20, failed: on *R. hirtellum*, 327, Je. 4, '18, poor, II; 701, Ap. 28, '19, fair, II; 730, My. 2, '19, failed (inoc. on upper surface); 1293, My. 31, '20, fair, II: on *R. holosericeum*, 321, Je. 4, '18, poor, II; 1318, My. 29, '20, fair, II: on *R. intermedium*, 325, Je. 4, '18, failed; 717, Ap. 28, '19, good, II; 732, My. 2, '19, failed (inoc. on upper surface); 760 My. 13, '19, fair, II; 1312, My. 29, '20, fair, II: on *R. longiflorum*, 316, Je. 4, '18, poor, II: on *R. luridum*, 691, Ap. 28, '19, good, II; 731, My. 2, '19, failed (inoc. on upper surface); 756, My. 13, '19, fair, II; 784, My. 13, '19, failed; 1308, My. 29, '20, fair, II: on *R. multiflorum*, 311, Je. 4, '18, failed: on *R. nigrum*, 298, My. 21, '18, good, II; 317, Je. 4, '18, poor, II; 328, Je. 3, '18, good, II; 330, Je. 5, '18, good, II, III; 345, My. 23–4, '18, good, II; 350, Je. 12, '18, failed (spores 43 days old); 351, Je. 12, '18, failed (spores 39 days old); 352, Je. 12, '18, good, II (spores 35 days old); 365, Je. 26, '18, poor, II (spores 49 days old); 368, Jl. 23, '18, failed (spores 76 days old); 644, N. 26, '18, poor, II; 658, Ap. 10, '19, good, II; 661, Ap. 12, '19, fair, II; 670, Ap. 21. '19, excellent, II; 674, Ap. 28, '19, good, II; 683, Ap. 28, '19, excellent, II; 734, My. 2, '19, failed (inoc. on upper surface); 741, My. 2, '19, excellent (inoc. on lower surface); 781, My. 13, '19, fair, II; 891, My. 23, '19, failed (spores left 45 days in Petri dish); 892, My. 23, '19, failed (spores 45 days old); 1304, My. 29, '20, fair, II; 4008, Je. 15, '22, fair, II: on *R. nigrum aconitifolium*, 930, Je. 4, '19, failed; 1302, My. 29, '20, fair, II: on *R. odoratum*, 1300, My. 29, '20, good, II: on *R. orientale*, 319, Je. 4, '18, failed: on *R. oxyacanthoides*, 326, Je. 4, '18, good, II; 673, 719, Ap. 28, '19, excellent, II; 740, My. 2, '19, failed (inoc. on upper surface); 780, My. 13, '19, fair, II; 1299, My. 29, '20, fair, II: on *R. pinetorum*, 315, Je. 4, '18, failed: on *R. robustum*, 711, Ap. 28, '19, poor, II; 775, My. 13, '19, failed; 931, Je. 4, '19, good, II; 1316, My. 29, '20, fair, II; 1332, Je. 3, '20, failed?: on *R. stenocarpum*, 314, Je. 4, '18, failed; 776, My. 13, '19, failed; 1298, My. 29, '20, failed: on *P. tenue*, 709, Ap. 28, '19, failed; 737, My. 2, '19, failed (inoc. on upper surface); 768, My. 13, '19, failed; 1295, My. 29, '20, failed: on *R. urceolatum*, 310, Je. 4, '18, failed: on *R. vulgare*, 320, Je. 4, '18, fair, II; 677, Ap. 28, '19, good, II; 738, My. 2, '19, failed (inoc. on upper surface): on *R. vulgare* (Fay's Prolific), 308, Je. 4, '18, fair, II; 657, Ap. 10, '19, fair, II; 660, Ap. 12, '19, fair, II; 672, Ap. 28, '19, good, II; 713, Ap. 28, '19, poor, II; 728, My. 2, '19, failed (inoc. on upper surface); 764, My. 13, '19, good, II; 1307, My. 29, '20, poor, II: on *R. vulgare* (small currant), 318, Je. 4, '18, fair, II; 705, Ap. 28, '19, fair, II; 735, My. 2, '19, poor (1 sorus, II; prob. accidental, inoc. on upper surface); 1309, My. 29, '20, poor, II: on *R. vulgare* (white currant), 307, Je. 4, '18, fair, II; 721, Ap. 28, '19, good, II; 739, My. 2, '19, failed (inoc. on upper surface); 1311, My. 29, '20, fair, II: on *Ribes* sp. (large gooseberry), 323, Je. 4, '18, good, II; 675, Ap. 28, '19, poor, II; 681, Ap. 28, '19, failed; 733, My. 2, '19, failed (inoc. on upper surface); 774, My. 13, '19, failed; 1303, My. 29, '20, failed: on *Ribes* sp. (Smith's small gooseberry), 322, Je. 4, '18, poor, II; 703, Ap. 28, '19, fair, II; 736, My. 2, '19, failed (inoc. on upper surface); 766, My. 13, '19, failed; 1297, My. 29, '20, failed. See Plate XXVd.

Inoculations with I and repeating with II stage. These inoculations all started with the I spores from *Pinus Strobus* on the various species of *Ribes* and then were repeated on the same species of *Ribes* through the II spores produced in the successive generations. In this way we were able to produce from one to nine distinct generations on the different hosts. The most successful host for inoculation was *Ribes nigrum* on which in the best test were produced one generation from the I spores and eight generations from the II spores before failure resulted on account of the very warm summer weather. In this series the III stage appeared with the II in the seventh generation. We know of no one who has carried on so extended a generation test under such exact conditions. Other hosts on which the rust was carried for five or more generations were *Ribes Cynosbati* and *R. vulgare*.

I, II stages on *Ribes alpinum* ♀: I stage on 792 (1), My. 13, '19, poor, II, III; II on 792 (2), Je. 5, good, II, III.

I, II stages on *R. americanum*: I stage on 707 (1), Ap. 28, '19, good, II; II on 707 (2), My. 12, failed. I on 715 (1), Ap. 28, '19, fair, II; II on 715 (2), My. 12, poor, II; II on 715 (3), Je. 5, failed.

I, II stages on *R. Cynosbati*: I stage on 789 (1), My. 13, '19, fair, II; II on 789 (2), Je. 5, poor, II; II on 789 (3), Je. 23, poor, II; II on 789 (4), Jl. 15, poor, II; II on 789 (5), Jl. 25 and Au. 5, poor, II; II on 789 (6), Au. 13, failed.

I, II stages on *R. fasciculatum chinense*: I stage on 699 (1), Ap. 28, '19, fair, II; II on 699 (2), My. 12, poor, II; II on 699 (3), Je. 5, poor, II.

I, II stages on *R. hirtellum:* I on 701 (1), Ap. 28, '19, fair, II; II on 701 (2), My. 12, failed.

I, II stages on *R. intermedium:* I stage on 717 (1) ,Ap. 28, '19, fair, II; II on 717 (2), My. 14, poor, II; II on 717 (3), Je. 5, failed.

I, II stages on *R. luridum:* I stage on 691 (1), Ap. 28, '19, good, II; II on 691 (2), My. 12, poor, II; II on 691 (3), Je. 5, fair, II.

I, II stages on *R. nigrum:* I stage on 658 (1), Ap. 10, '19, good, II; II on 658 (2), Ap. 25 and My. 3, fair, II; II on 568 (3), My. 9 and 12, poor, II; II on 568 (4), Je. 4 and 23, failed. I stage on 661 (1), Ap. 12, '19, good, II; II on 661 (2), Ap. 25 and My. 3, good, II; II on 661 (3), My. 12–13, good, II; II on 661 (4), My. 24 and 28, good, II; II on 661 (5), Je. 10 and 16, good, II; II on 661 (6), Je. 20 and 23, fair, II; II on 661 (7), Jl. 14, 18 and 25, poor, II and III; II on 661 (8), Jl. 25, 28 and Au. 5, poor, II; II on 661 (9), Au. 13 and 26, fair, II, III; II on 661 (10), Au. 26, failed. I stage on 670 (1), Ap. 21, '19, excellent, II; II on 670 (2), My. 1, excellent, II; II on 670 (3), My. 12, good, II; II on 670 (4), My. 28, good, II; II on 670 (5), Je. 10, 16, good, II; II on 670 (6), Je. 20 and 23, fair, II; II on 670 (7), Jl. 23, 28, Au. 4, poor, II; II on 670 (8), Au. 26, poor, II. I stage on 674 (1), Ap. 28, '19, good, II; II on 674 (2), My. 12, fair, II; II on 674 (3), Je. 5, failed. I stage on 997 (1), Je. 16, '19, excellent, II; II on 997 (2), Jl. 12, fair, II, III; II on 997 (3), Jl. 24, 28, 30, fair, II; II on 997 (4), Au. 5 and 13, poor, II.

I, II stages on *R. oxyacanthoides:* I stage on 673 (1), Ap. 28, '19, excellent, II; II on 673 (2), My. 12, failed. I stage on 719 (1), Ap. 28, '19, excellent, II; II on 719 (2), My. 12, good, II; II on 719 (3), Je. 5 and 23, failed.

I, II stages on *R. robustum:* I stage on 931 (1), Je. 4, '19, good, II; II on 931 (2), Je. 23, poor, II; II on 931 (3), Jl. 15, 18 and 21, poor, II; II on 931 (4), Au. 1, failed.

I, II stages on *R. vulgare:* I stage on 657 (1), Ap. 10, '19, fair, II; II on 657 (2), Ap. 23, My. 3, poor, II; II on 657 (3), My. 9 and 13, poor, II;

II on 657 (4), My. 22, poor, II; II on 657 (5), Je. 5, poor, II; II on 657 (6), Jl. 15, failed. I stage on 660 (1), Ap. 12, '19, fair, II; II on 660 (2), Ap. 25, My. 3, fair, II; II on 660 (3), My. 9 and 13, poor, II; II on 660 (4), My. 21, failed.

I, II stages on *R. vulgare* (Fay's Prolific): I on 672 (1), Ap. 28, '19, good, II; II on 672 (2), My. 12, failed.

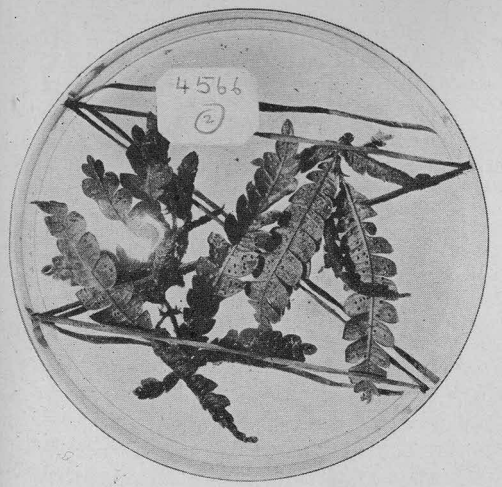
I, II stages on *R. vulgare* (small currant): I stage on 705 (1), Ap. 28, '19, fair, II; II on 705 (2), My. 12, poor, II; II on 705 (3), Je. 5, failed.

I, II stages on *R. vulgare* (white currant): I stage on 721 (1), Ap. 28, '19, good, II; II on 721 (2), My. 12, failed.

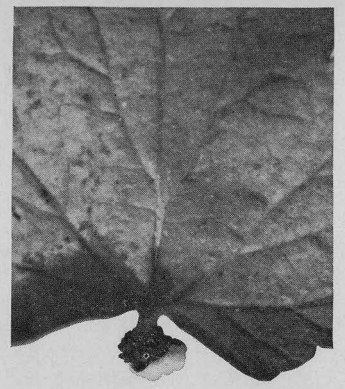
I, II stages on *Ribes* sp. (large gooseberry): I stage on 675 (1), Ap. 28, '19, poor, II; II on 675 (2), My. 12, failed.

Inoculations with II stage from *Ribes nigrum.* In this series the II spores were all from *Ribes nigrum* and were successful on the following hosts: *Ribes alpinum* ♀, *R. americanum, R. aureum chrysococcum, R. Cynosbati, R. Cynosbati inerme, R. divaricatum, R. fasciculatum chinense, R. Grossularia (uva-crispa), R. hirtellum, R. holosericeum, R. intermedium, R. longiflorum, R. luridum, R. nigrum, R. nigrum aconitifolium, R. oxyacanthoides, R. robustum, R. tenue, R. vulgare, Ribes* sp. (Smith's small gooseberry). That twenty species took out of thirty-one tried, as compared with fifteen out of twenty-five where the II spores were from *Ribes vulgare* (*q. v.*) were used, was due probably to the fact that more inoculations were made on each host and more spores used. In general the species inoculated from these two hosts corresponded quite closely in results obtained. Altogether eighty inoculations were made from *R. nigrum*, of which thirty-three or 41% were successful, which is lower than from *Ribes vulgare*, but the number of sori produced was greater than with the latter host.

II stage from *Ribes nigrum*: on *Parnassia caroliniana*, 565, 0.3, '18, failed: on *Ribes alpestre*, 375, S. 13, '18, failed; 526, S. 28, '18, failed; 1038, Au. 6, '19, failed; 1061, Au. 13, '19, failed: on *R. alpinum* ♀, 428, S. 17, '18, fair, II, III: on *R. alpinum* ♂, 376, S. 13, '18, failed; 523, S. 28, '18, failed; 1030, Au. 6, '19, failed; 1059, Au. 13, '19, failed: on *R. americanum*, 374, S. 13, '18, fair, II, III; 1047, Au. 7, '19, failed; 1057, Au. 13, '19, failed: on *R. aureum*, 1040, Au. 7, '19, failed; 1065, Au. 13, '19, failed: on *R. aureum chrysococcum*, 392, S. 13, '18, good, II, III; 398, S. 14, '18, failed; 527, S. 28, '18, failed; 1043, Au. 7, '19, failed; 1068, Au. 13, '19, failed: on *R. caucasicum*, 381, S. 13, '18, failed; 524, S. 28, '18, failed; 1032, Au. 6, '19, failed: on *R. curvatum*, 380, S. 13, '18, failed; 529, S. 28, '18, failed; 1051, Au. 7, '19, failed; 1056, Au. 13, '19, failed: on *R. Cynosbati*, 377, S. 13, '18, good, II; 396, S. 14, '18, good, II; 1041, Au. 7, '19, poor, II: on *R. Cynosbati inerme*, 397, S. 14, '18, poor, II; 1036, Au. 6, '19, fair, II: on *R. diacantha*, 429, S. 17, '18, failed: on *R. divaricatum*, 379, S. 13, '18, good, II; 1037, Au. 6, '19, failed: on *R. fasciculatum chinense*, 399, S. 14, '18, good, II: on *R. Grossularia*, 1033, Au. 6, '19, failed: on *R. Grossularia (uva-crispa)*, 382, S. 13, '18, fair, II: on *R. giraldii*, 378, S. 13, '18, failed; 528, S. 28, '18, failed; 1053, Au. 7, '19, failed; 1067, Au. 13, '19, failed: on *R. hirtellum*, 383, S. 13, '18, good, II, III; 1049, Au. 7, '19, failed: on *R. holosericeum*, 384, S. 13, '18, failed; 525, S. 28, '18, failed; 1048, Au. 7, '19, fair, II, III; 1063, Au. 13, '19, failed: on *R. intermedium*, 385, S. 13, '18, good, II, III; 1044, Au. 7, '19, fair, II: on *R. longiflorum*, 400, S. 14, '18, fair, II, III: on *R. luridum*, 386, S. 13, '18, good, II, III; 1046, Au. 7, '19, failed: on *R. nigrum*, 387,

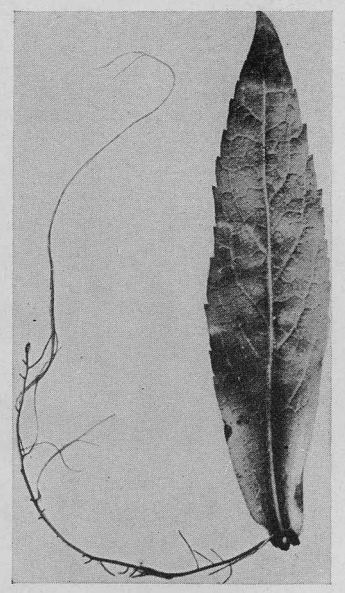


a. II stage of *Cronartium Comptoniae* on *Myrica asplenifolia*, pp. 479, 484.



b. Callus on petiole of *Ribes nigrum*, p. 480.

c. II stage of *Cronartium ribicola* on *Ribes nigrum*, p. 485.



d. Roots from callus on *Solidago rugosa*, p. 480.

ARTIFICIAL INOCULATIONS IN PETRIE DISHES.

S. 13, '18, good, II, III; 997, Jl. 12, '19, fair, II; 1069, Au. 5, '19, excellent, II, III: on *R. nigrum aconitifolium*, 388, S. 13, '18, good, II, III; 1035, Au. 6, '19, fair, II, III; 1058, Au. 13, '19, fair, II: on *R. oxyacanthoides*, 395, S. 13, '18, good, II, III: on *R. robustum*, 391, S. 13, '18, good, II, III; 1031, Au. 6, '19, poor, II; 1064, Au. 13, '19, fair, II, III: on *R. stenocarpum*, 390, S. 13, '18, failed; 522, S. 28, '18, failed; 1045, Au. 7, '19, failed; 1062, Au. 13, '19, failed: on *R. tenue*, 389, S. 13, '18, good, II, III; 1042, Au. 7, '19, failed; 1060, Au. 13, '19, failed: on *R. vulgare*, 394, S. 13, '18, fair, II, III: on *R. vulgare* (white currant), 1050, Au. 7, '19, failed: on *Ribes* sp. (large gooseberry), 1052, Au. 7, '19, failed: on *Ribes* sp. (Smith's small gooseberry), 393, S. 13, '18, fair, II, III; 1034, Au. 6, '19, failed; 1066, Au. 13, '19, failed.

II from *Ribes nigrum* (Petri dish): on *R. nigrum*, 366, Je. 26, '18, good, II; 508, S. 25, '18, poor, III; 645, D. 9, '18, failed; 1027, Jl. 28 '19, fair, II.

Inoculations with II stage from *Ribes vulgare*. In this series the II spores were all from *Ribes vulgare* and successful inoculations were made on the following hosts: *Ribes americanum*, *R. Cynosbati*, *R. Cynosbati inerme*, *R. fasciculatum chinense*, *R. Grossularia (uva-crispa)*, *R. hirtellum*, *R. intermedium*, *R. longiflorum*, *R. luridum*, *R. nigrum*, *R. nigrum aconitifolium*, *R. orientale*, *R. oxyacanthoides*, *R. robustum*, and *Ribes* sp. (Smith's small gooseberry). The best results were obtained with *R. Cynosbati*, *R. longiflorum*, *R. nigrum*, and *R. oxyacanthoides*. Of the twenty-seven inoculations made fifteen, or 56%, were successful. All the inoculations, except the last two, were made on Sept. 17, 1918.

II stage from *Ribes vulgare*: on *R. alpestre*, 402, failed: on *R. alpinum* ♀, 427, failed: on *R. alpinum* ♂, 403, failed: on *R. americanum*, 401, poor, II: on *R. aureum chrysococcum*, 420, failed: on *R. caucasicum*, 405, failed: on *R. curvatum*, 409, failed: on *R. Cynosbati*, 404, good, II: on *R. Cynosbati inerme*, 406, poor, II: on *R. fasciculatum chinense*, 421, poor, II: on *R. Grossularia (uva-crispa)*, 410, poor, II, III: on *R. giraldii*, 407, failed: on *R. hirtellum*, 412, poor, II: on *R. holosericeum*, 411, failed: on *R. intermedium*, 413, poor, II, III: on *R. longiflorum*, 425, good, II, III: on *R. luridum*, 414, poor, II, III: on *R. nigrum*, 415, good, II, III: on *R. nigrum aconitifolium*, 416, poor, II, III: on *R. orientale*, 422, poor, II: on *R. oxyacanthoides*, 426, good, II: on *R. robustum*, 417, poor, II, III: on *R. stenocarpum*, 418, failed: on *R. tenue*, 419, failed: on *R. vulgare*, 424, failed; 998 (Fay's Prolific), Jl. 12, '19, failed: on *Ribes sp.* (Smith's small gooseberry), 423, S. 17, '18, poor, III.

Inoculations with II stage from *Ribes* sps. The host species from which the II spores were obtained are uncertain but the results were quite successful in each case.

II from *Ribes* sp.: on *R. nigrum*, 299, My. 27, '18, good, II; 329, Je. 3, '18, good, II; 331, Je. 5, '18, excellent, II, III: on *R. vulgare*, 300, My. 27, '18, good, II.

Inoculations from III stage. There was no indication from these experiments that the III stage from *Ribes* could re-inoculate *Ribes*. When tried on pine leaves, however, the results were successful in one case where the juvenile-form leaves were still attached to a young shoot. Results as a rule are not to be expected even here as

no sign of infection is usually visible for a month or two after inoculation. In the successful case reported there was a slight golden-yellow spotting thirty-eight days after inoculation and sections showed the characteristic sclerotial masses present.

III stage from *Ribes nigrum:* on *Pinus Strobus*, 584 (stem uncut), O. 7, '18, failed; 585 (stem cut), O. 7, 18, failed; 589 (stems uncut and buds), O. 8, '18, failed; 583 (leaves), O. 7, '18, failed; 588, O. 8, '18, good, (yellow spots and sclerotia): on *Ribes intermedium*, 1112, O. 25 '19, failed: on *R. nigrum*, 631, O. 19, '18, failed; 1113, O. 25, '19, failed.

Gymnoconia interstitialis (Schl.) Lagerh.

Infections from the I stage resulted from *Rubus allegheniensis* on *R. allegheniensis* and *R. villosus;* from *R. hispidus* on *R. hispidus* and *R. villosus;* from *R. occidentalis* on *R. hispidus;* from *R. villosus* on *R. hispidus* and *R. villosus*. The III stage appeared in all cases. Only ten out of forty-six infections, or 22% were successful. This low rate is due in part to the leaves not keeping in good condition long enough to secure results, as it takes some time for the sori to mature.

I stage from *Rubus allegheniensis (R. villosus)*: on *R. allegheniensis* (wild), 1357, Je. 30, '20, fair, III: on *R. villosus*, 336, 337, Je. 6, '18, failed; 1358, Je. 30, '20, good, III.

I stage from *Rubus hispidus*: on *R. hispidus*, 4302, Je. 2, '23, fair, III; 4340, Je. 15, '23, failed: on *R. villosus*, 338, 339, Je. 6, '18, failed; 959, Je. 11, '19, excellent, III; 3087, Je. 5, '22, failed; 4295, Je. 1, 4203, Je. 2, '23, failed; 4341, Je. 15, '23, good, III: on *Rubus*, sps. (wild and cult. raspberry), 3084, 3085, Je. 5, '22, failed; 4296, Je. 1, '23, failed: on *Rubus* sp. (cult. blackberry), 3086, Je. 5, '22, failed; 4294, Je. 1, '23, failed. See Plate XXVb.

I stage from *Rubus occidentalis:* on *R. allegheniensis*, 1350 (wild), 1354 (Erie), 1356, (Snyder), Je. 22, '20, failed; 3090 (cult.), Je. 5, '22, failed; 4310 (cult.), Je. 8, '23, failed; 4353 (cult.), Je. 20, '23, failed; 4356, Je. 20, '23, failed: on *R. hispidus*, 4311, Je. 8, '23, poor, III; 4354, Je. 20, '23, failed; 4357, Je. 20, '23, failed: on *R. occidentalis*, 1346, 1352, Je. 22, '20, failed: on *R. villosus*, 1348, Je. 22, '20, failed; 3091, Je. 5, '22, failed; 4309, Je. 8, '23, failed; 4352, Je. 20, '23, failed; 4355, Je. 20, '23, failed; 4581, Jl. 2, '24, failed: on *Rubus* sps. (cult. and wild raspberry), 3088–89, Je. 5, '22, failed.

I stage from *Rubus villosus (R. canadensis):* on *R. allegheniensis*, 4326, Je. 12, '23, failed; on *R. hispidus*, 4338, Je. 15, '23, excellent, III: on *R. villosus*, 4325, Je. 12, '23, poor, III; 4339, Je. 15, '23, failed; 4580, Jl. 2, '24, good, III; 4585, Jl. 10, '24, excellent, III.

I stage from *Rubus* sps. (wild raspberry): on *R. villosus*, 960, Je. 11, '19, failed: on *Rubus* sps. 970, Je. 13, '19, failed.

Gymnosporangium.

Of the five species tried from this genus we were successful in securing infections with only two, chiefly because the wrong host or the O stage was used with the other three. Altogether thirty-nine tests were made of which fourteen or 36% were successful. With *G. Juniperi-virginianae*, where more likely hosts were used,

46% of the inoculations were successful. With *Gymnosporangium* successful results in Petri dishes are to be expected only with the III stage and with this only the O stage appears since the length of time to develop the I stage is too great to keep the leaves alive.

Gymnosporangium clavariaeforme (Jacq.) DC.

This failure is probably due to the use of the wrong host, as *Pyrus* is not given by Kern (N. A. F.) as one for this species which usually occurs on *Amelanchier* sps., and *Cydonia vulgaris*, both hosts in Connecticut.

III stage from *Juniperus communis:* on *Pyrus ioensis* (Bechtel's Fl. Crab), 923, My. 27, '19, failed.

Gymnosporangium clavipes Ck. & Pk.

The usual hosts for this species are *Amelanchier*, *Crataegus* and *Cydonia*, although Kern (N. A. F.) gives *Pyrus Malus* as a host from Massachusetts. *Pyrus*, however, does not seem to be a very susceptible host from our results.

O stage from *Amelanchier* sp.: on *Pyrus ioensis*, 936, Je. 6, '19, failed.

III stage from *Juniperus virginiana*: on *Pyrus ioensis* (Bechtel's Fl. Crab) 922, My. 27, '19, failed: on *P. Malus* (Wealthy) 811, My. 20, '19, failed.

Gymnosporangium cornutum (Pers.) Arth.

As in all species tried no results were obtained from inoculations with the O stage. This rust, however, has not been listed on the hosts tried here so the results do not mean so much as if *Sorbus* had been used.

O stage from *Sorbus americana:* on *Crataegus crus-galli*, 967, Je. 12, '19, failed: on *Pyrus ioensis*, 968, Je. 12, '19, failed: on *P. Malus* (Wealthy), 969, Je. 12, '19, failed.

Gymnosporangium Juniperi-virginianae Schw.

Here inoculations with the O stage were made on hosts known to be very susceptible but without results which seems to indicate that the O stage is not a means of spreading the rust. Inoculations with the III stage were successful on *Pyrus ioensis* and *P. Malus* only, the other species, *Pyrus communis* and *Cydonia vulgaris*, not being reported as hosts for this species by Kern. All three inoculations took on the Bechtel's Flowering Crab which is a very susceptible species. On *Pyrus Malus*, however, the results varied with the different varieties used, failing on Baldwin, Gravenstein, McIntosh and Northern Spy, taking poorly on Fall Pippin, Greening, King and Sutton's Beauty, and taking well on Duchess of Oldenburg, Hurlburt, Russet and Wealthy. These results agree well with the observations we have made on these varieties

in nature. The Petri dish method seems to be a very easy way to test the susceptibility of different varieties of apples to these rusts. Of the inoculations with the III stage 52% were successful.

O stage from *Pyrus Malus*: on *Pyrus ioensis*, 953, Je. 9, '19, failed: on *Pyrus Malus* (Wealthy), 954, Je. 9, '19, failed; 4030–32 (young and old leaves), Je. 20, '22, failed.

I stage from *Pyrus Malus*: on *Juniperus virginiana*, 1029, Au. 5, '19, failed.

III stage from *Juniperus virginiana*: on *Cydonia vulgaris*, 801, My. 19, '19, failed; 940, Je. 7, '19, failed: on *Pyrus communis*, 800, My. 19, '19, failed; 938 (Seckel), Je. 7, '19, failed; 939, Je. 7, '19, failed: on *P. ioensis* (Bechtel's Fl. Crab), 799, My. 19, '19, excellent, O; 924, My. 27, '19, poor, O; 937, Je. 7, '19, good, O; 4306, Je. 7, '23, excellent, O: on *P. Malus*, 798, My. 19, '19, failed; 810 (Baldwin), My. 20, '19, failed; 942 (Baldwin), Je. 7, '19, failed; 943 (Duchess of Oldenberg), Je. 7, '19, good, O; 941 (Fall Pippin), Je. 7, '19, poor, O; 946 (Gravenstein), Je. 7, '19, failed; 952 (Greening), Je. 7, '19, poor, O; 950 (Hulbert), Je. 7, '19, good, O; 946 (King), Je. 7, '19, poor, O; 947 (McIntosh), Je. 7, '19, failed; 944 (Northern Spy), Je. 7, '19, failed; 951 (Russet), Je. 7, '19, good, O; 948 (Sutton's Beauty), Je. 7, '19, poor, O; 809 (Wealthy), My. 20, '19, good, O; 949 (Wealthy), Je. 7, '19, poor, O. See Plate XXVc.

Gymnosporangium nidus-avis Thaxt.

Successful inoculations were made with this species only on Quince (*Cydonia vulgaris*) and the Wealthy apple, failing on the other varieties of *Pyrus Malus*, the Pear and Bechtel's Crab. Wealthy is one of the most susceptible varieties of apples to *Gymnosporangium Juniperi-virginianae* but Kern (N. A. F. **7**[3]: 196.) does not list *Pyrus Malus* as a host for *G. nidus-avis* and it may be that in nature it does not attack the apple.

III stage from *Juniperus virginiana:* on *Cydonia vulgaris*, 805, My. 19, '19, fair, O: on *Pyrus communis*, 804, My. 19, '19, failed: on *P. ioensis*, 803, My. 19, '19, failed: on *P. Malus*, 802, My. 19, '19, failed; 813 (Baldwin), My. 20, '19, failed; 812 (Wealthy), My. 20, '19, fair, O.

Kuehneola albida (Kuehn) Magn.

Only two inoculations out of nine were successful with this species, taking from *Rubus allegheniensis* and *R. hispidus* on the same species. This seems too low considering the hosts and character of the spore material used, but perhaps the lateness of the season with some of the inoculations explains their failure.

II stage from *Rubus allegheniensis:* on *R. allegheniensis*, 1070, S. 9, '19, poor, II: on *R. villosus*, 1071, S. 9, '19, failed: on *Rubus* sp. (raspberry), 1072, S. 9, '19, failed.

II stage from *Rubus hispidus:* on *R. hispidus*, 4298, Je. 1, '23, fair, II: *R. villosus*, 4297, Je. 1, '23, failed.

II stage from *Rubus villosus*: on *R. villosus*, 4621, S. 16, '24, failed.

II stage from *Rubus* sp. (wild blackberry), on *R. allegheniensis*, 1546, N. 10, '20, failed: on *R. villosus*, 1545, N. 10, '20, failed: on *Rubus* sp. (cult. raspberry), 1547, N. 10, '20, failed.

Melampsora sps.

We have carried on a considerable number of inoculations with *Melampsora* species from *Populus* and *Salix* on various species of *Betula, Populus* and *Salix*. Uniform failure to inoculate *Betula*, on both trees and in Petri dishes, has eliminated the rust on that host from consideration, on infectional as well as on morphological grounds, as stated subsequently under *Melampsoridium*. The only reason for making these inoculations was the frequent association of the *Betula* rust with those on *Populus* and *Salix*.

Examining our Connecticut herbarium specimens on *Populus* and *Salix*, we find that there are slight morphological characters that apparently separate them into four species, two on *Salix* and two on *Populus*. Yet we are not sure whether these might not be more satisfactorily combined in fewer species. Our inoculations have also given conflicting results, II spores from both *Populus grandidentata* and *P. tremuloides* having apparently infected leaves of *Salix*; also II spores from *Populus tremuloides* took on *P. grandidentata* but not from the latter on the former, while II spores from *Salix* sp. failed on both the poplars. The rusts on these three hosts have been found associated in the same locality with *Caeoma Abietis-canadensis* and their II stages are very similar. All these observations have caused us to question whether we were dealing with three or one species. See notes under each.

Melampsora Abietis-canadensis (Farl.) Ludw.

The inoculations with the I stage (*Caeoma Abietis-canadensis*) from *Tsuga canadensis* took in all the tests (except possibly one) on *Populus grandidentata* and failed on *Betula* and *Salix* sps. and on all the other species of *Populus* except one doubtful sorus on *P. tremuloides*, the other two trials on this host failing though taking at the same time on *P. grandidentata*. The inoculations with the II stage from *Populus grandidentata* were uniformly failures, even on *P. grandidentata*, except the very suspicious infection on *Salix* sp. which leaves possibly were already infected, as the first sori appeared within five days after inoculation.

I stage from *Tsuga canadensis:* on *Betula* sp., 4010, Je. 17, '22, failed: on *Populus alba*, 4009, Je. 16, '22, failed; 4014, Je. 17, '22, failed: on *P. deltoides*, 3096, Je. 15, '22, failed: on *P. grandidentata*, 3094, Je. 15, '22, fair, II; 4011, Je. 17, '22, poor, II; 4021, Je. 19, '22, failed?; 4586, Jl. 10, '24, poor, II: on *P. nigra italica*, 3093, Je. 15, 4013, Je. 17, '22, failed: on *P. tremuloides*, 3095, Je. 15, '22, poor, II (one sorus); 4012, Je. 17, '22, failed; 4587, Jl. 10, '24, failed: on *Salix* sps., 4401–2, Je. 15, '22, failed; 4015–18, Je. 17, '22, failed; 4022–29, Je. 19, '22, failed.

II stage from *Populus grandidentata*: on *Betula lenta*, 557, O. 2, '18, failed: on *B. populifolia*, 554, O. 2, '18, failed: on *Populus deltoides*, 1510, O. 28, '20, failed: on *P. grandidentata*, 560, O. 2, '18, failed; 1498, O. 27, '20, failed; 1500, O. 28, '20, failed: on *P. tremuloides*, 563, O. 2, '18, failed; 1497, O. 27, '20, failed: on *Salix* sp. (New Haven), 1501, O. 28, '20, fair, II.

Melampsora americana Arth.

The II stage from *Salix* sps. failed on the three species of *Betula* and the six of *Populus* that were inoculated. It also failed on certain species of *Salix* but took on others, six of the twelve inoculations being successful.

II stage from *Salix* sp: on *Betula alba papyrifera*, 448, S. 20, '18, failed: on *B. lenta*, 449, S. 20, '18, failed; 1451, O. 14, '20, failed; 1489, O. 27, '20, failed; 1512, O. 28, '20, failed: on *B. populifolia*, 450, S. 20, '18, failed; 1450, O.14, '20, failed; 1490, O. 27, '20, failed; 1513, O. 28, '20, failed: on *Populus alba*, 451, S. 20, '18, failed; 1509, O. 28, '20, failed; 1519, O. 28, '20, failed: on *P. balsamifera*, 452, S. 20, '18, failed: on *P. deltoides*, 453, S. 20, '18, failed; 1504, O. 28, '20, failed; 1520, O. 28, '20, failed: on *P. grandidentata*, 454, S. 20, '18, failed; 1449, O. 14, '20, failed; 1492, O. 27, '20, failed; 1507, 1517, O. 28, '20, failed: on *P. nigra italica*, 455, S. 20, '18, failed; 1508, 1518, O. 28, '20, failed: on *P. tremuloides*, 456, S. 20, '18, failed; 1448, O. 14, '20, failed; 1491, O. 27, '20, failed; 1506, 1516, O. 28, '20, failed: on *Salix amygdalina* (3), 484, S. 21, '18, poor, II; 495, S. 21, '18, failed: on *S. amygdalina americana* (2), 494, S. 21, '18, failed: on *S. pentandra* (5, Lemley), 497, S. 21, '18, poor, II; 1502, 1514, O. 28, '20, failed; on *S. purpurea* (1 and 4), 493, 496, S. 21, '18, failed; on *Salix* sp. (New Haven), 1447, O. 14, '20, poor, II; 1503, O. 28, '20, good, II; 1505, O. 28, '20, poor, II; 1515, O. 28, '20, poor, II.

Melampsora Medusae Thuem.

The inoculations with the II stage from *Populus tremuloides* on the same host took in good shape in three out of the four trials and failed on all the other species of *Populus*, *Betula* and *Salix*, except apparently in one case on *Populus grandidentata* and one on *Salix* sp. made at the same time and with same material that took on *P. tremuloides*. This means either that these two latter hosts were already infected when used or else that all three hosts are inhabited by the same species and not by three different ones as considered here.

II stage from *Populus tremuloides:* on *Betula alba*, 430, S. 20, '18, failed: on *Betula lenta*, 431, S. 20, '18, failed; 558, O. 2, '18, failed; 1461, O. 14, '20, failed: on *B. populifolia*, 432, S. 20, '18, failed; 555, O. 2, '18, failed; 1460, O. 14, '20, failed: on *Populus alba*, 433, S. 20, '18, failed: on *P. balsamifera*, 434, S. 20, '18, failed: on *P. deltoides*, 435, S. 20, '18, failed: on *P. grandidentata*, 436, S. 20, '18, failed; 561, O. 2, '18, failed; 1459, O. 14, '20, good, III: on *P. nigra italica*, 437, S. 20, '18, failed: on *P. tremuloides*, 438, S. 20, '18, good, II; 465, S. 20, '18, fair, II-III; 564, O. 2, '18, failed; 1458, O. 14, '20, good, II: on *Salix amygdalina* (3), 505, S. 21, '18, failed: on *S. amygdalina americana* (2), 504, S. 21, '18, failed: on *S. pentandra* (5), 507, S. 21, '18, failed: on *S. purpurea* (1), 503, S. 21, '18, failed: *S. purpurea* (4), 506, S. 21, '18, failed: on *Salix* sp. (New Haven), 1457, O. 14, '20, poor, II.

Melampsoridium betulinum (Pers.) Kleb.

All six inoculations with the I stage failed, but only one was made on *Betula* species. Only 18% of the thirty-three inoculations with the II stage was successful also for the reason that many

of them were made on *Populus* and *Salix*. In this state rusts on *Populus*, *Salix* and *Betula* often occur together and it was thought that possibly there might be some connection between them not yet discovered. As far as *Betula* is concerned both from these experiments and microscopical examination of the II stage found on it, there is but one species of rust and it does not occur on either *Populus* or *Salix*. If we consider only the inoculation from *Betula* sps. to *Betula* sps., the results are better, since 38% of these was successful. The favorable inoculations with the II stage were as follows: from *Betula populifolia* on *B. lenta* and *B. populifolia*. In the case of spores from *B. lenta* on these two hosts the results were negative probably because the number of inoculating spores was small.

I stage from *Larix americana:* on *Betula* sp., 4316, Je. 8, '23, failed: on *Populus deltoides*, 4314, Je. 8, '23, failed: on *P. grandidentata*, 4312, Je. 8, '23, failed: on *P. nigra italica*, 4313, Je. 8, '23, failed: on *Salix* sp., 4305, Je. 7, 4315, Je. 8, '23, failed.

II stage from *Betula lenta:* on *B. lenta*, 1485, O. 27, '20, failed: on *B. populifolia*, 1486, O. 27, '20, failed: on *Populus grandidentata*, 1488, O, 27, '20, failed: on *P. tremuloides*, 1487, O. 27, '20, failed.

II stage from *Betula populifolia:* on *B. alba papyrifera*, 439, S. 20, '18, failed: on *B. lenta*, 440, S. 20, '18, failed; 556, O. 2, '18, failed; 1456, O. 14, '20, poor, II; 1493, O. 27, '20, fair, II: on *B. populifolia*, 441, S. 20, '18, fair, II; 553, O. 2, '18, failed; 1455, O. 14, '20, failed; 1494, O. 27, '20, failed; 1499, O. 28, '20, poor, II; 1511, O. 28, '20, poor, II: on *Populus alba*, 442, S. 20, '18, failed: on *P. balsamifera*, 443, S. 20, '18, failed: on P. *deltoides*, 444, S. 20, '18, failed: on *P. grandidentata*, 445, S. 20, '18, failed; 559, O. 2, '18, failed; 1454, O. 14, '20, failed; 1496, O. 27, '20, failed: on *P. nigra italica*, 446, S. 20, '18, failed: on *P. tremuloides*, 447, S. 20, '18, failed; 562, O. 2, '18, failed; 1453, O. 14, '20, failed; 1495, O. 27, '20, failed: on *Salix amygdalina* (3), 500, S. 21, '18, failed: on *S. amygdalina americana* (2), 499, S. 21, '18, failed: on S. *purpurea* (1), 498, S. 21, '18, failed: on *S. purpurea* (4), 501, S. 21, '18, failed: on *S. pentandra* (5), 502, S. 21, '18, failed: on *Salix* sp., 1452, O. 14, '20, failed.

Melampsoropsis Cassandrae (Pk. & Clint.) Arth.

The results in this case are interesting since they confirm results obtained with plants in crocks, namely that *Picea mariana* and *P. rubra* are susceptible hosts for producing the O and I stages of this rust, while *P. excelsa* is not. The inoculations in the Petri dishes were made on leaves still attached to small branches and the O stage with pycniospores only appeared, the I stage appearing on the plants in the crocks.

III stage from *Cassandra calyculata:* on *Picea excelsa*, 347, Je. 8, '18, failed; 925, My. 27, '19, failed: on *P. mariana*, 956, Je. 11, '19, fair, O: on *P. rubra*, 972, Je. 14, '19, fair, O.

Melampsoropsis Pyrolae (D.C.) Arth.

This rust apparently winters over here through the II stage, as the I stage has not been found. It is not evident why the two

inoculations with the II stage failed since the leaves remained alive and healthy in the Petri dishes for a long time, and the spores seemed in good condition when used.

II stage from *Pyrola americana:* on *P. americana*, 4301, Je. 2, '23, failed: on *P. elliptica*, 4300, Je. 2, '23, failed.

Phragmidium Potentillae (Pers.) Karst.

Inoculations were successful in two out of the three tests of the II stage on *Potentilla canadensis* on the same host. The other attempts were made on plants known not to be the proper hosts.

II stage from *Potentilla canadensis*: on *Betula populifolia*, 569, O. 3, '18, failed: on *Populus grandidentata*, 568, O. 3, '18, failed: on *P. tremuloides*, 567, O. 3, '18, failed: on *Potentilla canadensis*, 566, O. 3, '18, failed; 996, Jl. 12, '19, poor, II; 1014, Jl. 19, '19, fair, II; 1014, II, a-b, Au. 5, '19, (a) excellent, II, (b) failed. See Plate XXVa.

Phragmidium subcorticium (Schr.) Wint.

With this species five out of the nine inoculations on *Rosa* species were successful. The failures seem to indicate that they were on varieties that were at least somewhat resistant to the rust.

II stage from *Rosa* sp. (cult.): on *Rosa rugosa*, 987, Jl. 12, '19, failed: on *Rosa* sp. (The Farquhar), 993, Jl. 12, '19, failed: on *Rosa* sp. (Ayrshire), 989, Jl. 12, '19, failed: on *Rosa* sp., 992, Jl. 12, '19, poor, II: on *Rosa* sp. (Frau Karl Druschki's hybrid perpetual), 994, Jl. 12, '19, poor, II: on *Rosa* sp. (Madame Plantier), 991, Jl. 19, '19, poor, II: on *Rosa* sp. (white), 990, Jl. 12. '19, poor, II: on *Rosa* sp. (Wichuraina), 988, Jl. 12, '19, failed.

II stage from *Rosa* sp. (Madame Plantier, Petri dish culture 991): on *Rosa* sp. (Madame Plantier), 1025, Jl. 25, '19, poor, II.

Puccinia sps.

We can discuss the results of inoculation with species of *Puccinia* altogether as the number of inoculations with most of them were too few to draw any special conclusions. In fact the work with *Puccinia*, as with *Uromyces*, was chiefly to determine how successful the Petri dish method would prove for those species of rusts that have their hosts on the more delicate leaves of herbaceous plants, many of which are also of such size that they have to be cut before they can be placed in the dish. Of the forty-six inoculations 35% was successful which is fair considering the difficulty of keeping the leaves in good condition. However, even with the successful ones, the amount of infection was not usually very abundant and often the sori appeared only shortly before the leaves died.

Altogether nineteen species of *Puccinia* were tried and infection resulted in nine as follows. *Puccinia Agropyri*: II stage from *Agropyron repens* on *A. repens*; II stage from *Triticum vulgare* on *Agropyron repens*. *Puccinia coronata*: II stage from *Avena sativa* on *A. sativa*. *Puccinia graminis*: II stage from *Agrostis alba* on *A. alba*; II stage from *Phleum pratense* on *P. pratense*. *Puccinia obscura:* II stage from *Luzula campestris* on *L. campestris*. *Puccinia Poarum:* II stage from *Poa pratensis* on *P. pratensis*. *Puccinia Pruni-spinosae:* I stage from *Anemone quinquefolia* on *Prunus serotina*. *Puccinia suaveolens:* II stage from *Cirsium arvense* on *C. arvense*. *Puccinia Violae:* I stage from *Viola blanda* on *V. blanda*. *Puccinia Thalictri:* III stage from *Thalictrum polygamum* on *P. polygamun*. (This last infection is considered doubtful).

Puccinia Agropyri Ell. & Ev.

I stage from *Thalictrum polygamum:* on *Carex* sp., 4332, Je. 13, '23, failed.

II stage from *Agropyron repens:* on *A. repens*, 1013, Jl. 19, '19, poor, II; 1028, Jl. 28, '19, failed; 4346, Je. 16, '23, failed: on *Panicum* sp., 999, Je. 12, '19, failed.

II stage from *Triticum vulgare:* on *Agropyron repens*, 1023, Jl. 19, '19, poor, II.

Puccinia Andropogi Schw.

I stage from *Chelone glabra:* on *Andropogon scoparius*, 4330, Je. 13, '23, fair, II; 4342, Je. 15, '23, failed.

III stage from *Andropogon scoparius:* on *Chelone glabra*, 4331, Je. 13, '23, failed.

Puccinia Anemones Pers.

III stage from *Anemone quinquefolia* (poor material): on *A. quinquefolia*, 4321, Je. 12, '23, failed: on *Thalictrum* sp., 4320, Je. 12,'23, failed.

Puccinia Asparagi DC.

II stage from *Asparagus officinalis:* on *A. officinalis*, 1055, Au. 12, '19, failed.

Puccinia coronata Cda.

II stage from *Avena sativa:* on *A. sativa*, 581, O. 7, '18, fair, II; 632, O. 22, '18, good, II, III; 641, O. 31, '18, poor, II; (II stage from Petri dish culture 632), 642, O. 31, '18, poor, II: on *Secale cereale*, 633, O. 22, '18, failed.

Puccinia Ellisiana Thuem.

I stage from *Viola* sp.: on *Andropogon* sp., 4343, Je. 15, '23, failed: on *Viola* sp., 4334, Je. 15, '23, failed.

Puccinia Eriophori Thuem.

I stage from *Senecio aureus:* on *Eriophorum viridi-carinatum*, 4322, Je. 12, '23, failed.

III stage from *Eriophorum viridi-carinatum:* on *Senecio aureus*, 4324, Je. 12, '23, failed.

Puccinia Fraxinata (Lk.) Arth.

I stage from *Fraxinus americana:* on *Agropyron repens*, 1010, Jl. 19, '19, failed: on *Fraxinus americana*, 1008, Jl. 19, '19, failed: on *Spartina patens juncea*, 1003, Jl. 18, '19, failed; 1005, Jl. 19, '19, failed: on *Spartina* sp. (large), 1002, Jl. 18, '19, failed; 1004, Jl. 19, '19, failed.

Puccinia graminis Pers.

I stage from *Berberis vulgaris:* on *Agrostis alba*, 4329, Je. 13, '23, failed.
II stage from *Agrostis alba:* on *A. alba*, 1011, Jl. 19, '19, poor, II.
II stage from *Phleum pratense:* on *P. pratense*, 1012, Jl. 19, '19, fair, II.

Puccinia Malvacearum Mont.

III stage from *Althaea rosea:* on *A. rosea*, 995, Jl. 12, '19, failed.

Puccinia obscura Schroet.

II stage from *Luzula campestris:* on *L. campestris*, 359, Je. 21, '18, failed; 934, Je. 6, '19, good, II.

Puccinia Poarum Niels.

II stage from *Poa pratensis:* on *P. pratensis*, 1000, Jl. 12, '19, poor, II.

Puccinia Porri (Sow.) Wint.

II stage from *Allium cepa* (Egyptian): on *A. cepa* (garden), 1054, Au. 12, '19, failed.

Puccinia Pruni-spinosae Pers.

I stage from *Anemone quinquefolia:* on *Prunus persica*, 4249, My. 19, '23, failed: on *Prunus serotina*, 900, My. 27, '19, poor, II; 4250, My. 19, '23, excellent, II: on *Prunus* sp. (cult. plum), 4248, My. 18, '23, failed.

Puccinia rubigo-vera (DC.) Wint.

II stage from *Secale cereale:* on *S. cereale*, 344, Je. 8, '18, failed.

Puccinia suaveolens (Pers.) Rostr.

II stage from *Cirsium arvense:* on *C. arvense*, 1018, Jl. 19, '19, fair, II; 1026, Jl. 28, '19, poor, II.

Puccinia Taraxaci Plowr.

II stage from *Taraxacum officinale:* on *T. officinale*, 1001, Jl. 14, '19, failed (leaves decayed); 4345, Je. 16, '23, failed.

Puccinia Thalictri Chev.

III stage from *Thalictrum polygamum:* on *T. polygamum*, 4318, Je. 12, '23, good, III (telia appeared in six days so host possibly already infected)?; 4347, Je. 16, '23, failed.

Puccinia Violae (Schum.) DC.

I stage from *Viola blanda:* on *V. blanda*, 935, Je. 6, '19, good, II.

Pucciniastrum Myrtilli (Schum.) Arth.

The reason the I stage took on *Gaylussacia baccata* and failed on *Vaccinium vacillans* is not entirely evident since the latter, questionably, has been collected as host for the II and III stages in this

state, and they were inoculated under apparently identical conditions. However, the *Gaylussacia* is a common host and the same year the inoculations were made we found it and *Vaccinium pennsylvanicum* infected together in a locality where *V. vacillans* was entirely free though close to the other infected hosts.

I stage from *Tsuga canadensis:* on *Gaylussacia baccata*, 4020, Je. 19, '22, excellent, II: 4041, Jl. 19, '22, good, II: on *Vaccinium vacillans*, 4019, Je. 19, '22, failed; 4042, Jl. 19, '22, failed.

Uromyces sps.

Only eight inoculations with five species of *Uromyces* were tried and of these only one was successful as follows. *Uromyces Trifolii:* II stage from *Trifolium pratense* on *T. pratense*.

Uromyces Caladii (Schw.) Farl.

I stage from *Arisaema triphyllum:* on *A. triphyllum*, 4307, Je. 8, '23, failed.

Uromyces Caryophyllinus (Schr.) Wint.

II stage from *Dianthus Caryophyllinus:* on *D. Carophyllinus*, 646, 647, 648, 649, D. 27, '18, failed.

Uromyces houstoniatus (Schw.) Sheld.

I stage from *Houstonia caerulea:* on *Hypoxis erecta*, 4282, My. 28, '23, failed: on *Luzula campestris*, 360, Je. 21, '18, failed: on *Sisyrinchium* sp., 4299, Je. 1, '23, failed.

Uromyces Lilii (Lk.) Fckl.

I stage from *Lilium* sp.: on *Lilium* sp., 361, Je. 21, '18, failed.

Uromyces Trifolii (Hedw.) Liro.

II stage from *Trifolium pratense:* on *T. hybridum*, 1017, Jl. 19, '19, failed: on *T. pratense*, 1015, Jl. 19, '19, poor, II.

TABLE I. RESULTS OF INOCULATIONS OF *Ribes* SPS. WITH *Cronartium ribicola*.

Comparison of Petri dish with pot inoculations.*

O—failure, P—poor, F—fair, G—good, E—excellent.

Scientific name of host inoculated.	I stage from Pinus Strobus.		II stage from Ribes species.		Average of tests.
	On leaves in Petri dishes.	On plants in crocks.	On leaves in Petri dishes.	On plants in crocks.	
Ribes alpestre	O in 3 tests.	O in 5 tests.	O in 5 tests.	No test.	O in 13 tests.
" alpinum ♂	O in 5 tests.	O in 2 tests.	O in 5 tests.	O in 1 test.	O in 13 tests.
" " ♀	P+ in 3 tests.	F+ in 4 tests.	F− in 3 tests.	P in 1 test.	F− in 11 tests.
" americanum	F− in 9 tests.	F− in 6 tests.	P− in 7 tests.	P in 2 tests.	P+ in 24 tests.
" aureum	P− in 5 tests.	F in 1 test.	O in 2 tests.	No test.	P− in 8 tests.
" " chrysococcum	P in 5 tests.	No test.	P− in 6 tests.	No test.	P− in 11 tests.
" caucasicum	F− in 4 tests.	F− in 3 tests.	O in 4 tests.	No test.	P+ in 11 tests.
" curvatum	O in 3 tests.	No test.	O in 5 tests.	No test.	O in 8 tests.
" Cynosbati	F+ in 3 tests.	F− in 1 test.	F− in 9 tests.	F in 1 test.	F− in 14 tests.
" " inerme	F in 1 test.	G in 1 test.	P+ in 3 tests.	No test.	F− in 5 tests.
" diacantha	F in 1 test.	F+ in 3 tests.	O in 1 test.	No test.	F− in 5 tests.
" divaricatum	F− in 5 tests.	G in 3 tests.	F− in 2 tests.	F in 1 test.	F+ in 11 tests.
" fasciculatum Chinense	F− in 3 tests.	F in 1 test.	F− in 4 tests.	No test.	F− in 8 tests.
" gracile	No test.	No test.	No test.	O in 1 test.	O in 1 test.
" Grossularia	O in 2 tests.	P in 1 test.	O in 1 test.	No test.	P− in 4 tests.
" " (uva-crispa)	F in 2 tests.	G in 1 test.	P+ in 2 tests.	No test.	F in 5 tests.
" giraldii	O in 6 tests.	O in 3 tests.	O in 5 tests.	No test.	O in 14 tests.
" hirtellum	P+ in 5 tests.	F+ in 4 tests.	P in 4 tests.	E in 1 test.	F− in 14 tests.
" holosericeum	F− in 2 tests.	No test.	P− in 5 tests.	No test.	P− in 7 tests.
" intermedium	F− in 6 tests.	G in 3 tests.	P+ in 5 tests.	G in 1 test.	F− in 15 tests.
" longiflorum	P in 1 test.	No test.	G− in 2 tests.	No test.	F in 3 tests.
" luridum	F− in 6 tests.	G− in 3 tests.	P+ in 5 tests.	P in 1 test.	F− in 15 tests.

TABLE I. RESULTS OF INOCULATIONS OF *Ribes* SPS. WITH *Cronartium ribicola*.

Comparison of Petri dish with pot inoculations.—*Concluded.*

O—failure, P—poor, F—fair, G—good, E—excellent.

Scientific name of host inoculated.	I stage from Pinus Strobus.		II stage from Ribes species.		Average of tests.
	On leaves in Petri dishes.	On plants in crocks.	On leaves in Petri dishes.	On plants in crocks.	
Ribes multiflorum	O in 1 test.	No test.	No test.	No test.	O in 1 test.
" nigrum	F+ in 27 tests.	G− in 19 tests.	F+ in 35 tests.	F in 23 tests.	F+ in 104 tests.
" " aconitifolium	P in 2 tests.	No test.	F in 4 tests.	No test.	F− in 6 tests.
" odoratum	G in 1 test.	O in 1 test.	No test.	No test.	F in 2 tests.
" orientale	O in 1 test.	No test.	P in 1 test.	O in 1 test.	P− in 3 tests.
" oxyacanthoides	G in 8 tests.	F+ in 6 tests.	F− in 5 tests.	P+ in 3 tests.	F+ in 22 tests.
" petraeum	No test.	F in 1 test.	No test.	No test.	F in 1 tests.
" pinetorum	O in 1 test.	G in 2 tests.	No test.	G in 1 test.	F+ in 4 tests.
" robustum	F− in 5 tests.	G− in 2 tests.	P+ in 7 tests.	No test.	F− in 14 tests.
" stenocarpum	O in 3 tests.	No test.	O in 5 tests.	No test.	O in 8 tests.
" tenue	O in 4 tests.	F in 2 tests.	F− in 4 tests.	No test.	P+ in 10 tests.
" urceolatum	O in 1 test.	No test.	No test.	No test.	O in 1 test.
" vulgare	F− in 5 tests.	G in 4 tests.	P+ in 11 tests.	O in 2 tests.	F− in 22 tests.
" " (Fay's prolific)	F− in 9 tests.	F+ in 8 tests.	O in 2 tests.	F− in 5 tests.	F− in 24 tests.
" " (Small)	F− in 5 tests.	G− in 8 tests.	P− in 2 tests.	P+ in 3 tests.	F− in 18 tests.
" " (White	F in 5 tests.	G− in 7 tests.	O in 2 tests.	F in 1 test.	F in 15 tests.
" Wolfii	No test.	No test.	No test.	P in 1 test.	P in 1 test.
" sp. (Large gooseberry)	F− in 7 tests.	P− in 9 tests.	O in 2 tests.	O in 2 tests.	P in 20 tests.
" " (Smith's gooseberry)	P− in 5 tests.	P in 9 tests.	P− in 4 tests.	P− in 4 tests.	P− in 22 tests.
Totals	P+ in 170 tests.	F− in 123 tests.	P+ in 169 tests.	F− in 56 tests.	518 tests.
Percent. successful	66%	78%	57%	57%	65%

* Average of the tests given in each case.

INDEX.

CONNECTICUT
AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Second Annual Report

OF THE

TOBACCO STATION

AT

WINDSOR

For the year ending October 31, 1923

The Connecticut Agricultural Experiment Station

and

The Connecticut Valley Tobacco Improvement Association

coöperating

LETTER OF TRANSMITTAL

To His Excellency, Charles H. Templeton, Governor of Connecticut:

The Board of Control of the Connecticut Agricultural Experiment Station herewith submits the Second Annual Report of the Tobacco Station for the year ending October 31, 1923, as required by Act of the General Assembly. (Chapter 184, Public Acts, 1921.)

Respectfully,

GEORGE A. HOPSON,

Secretary.

REPORT OF

E. H. JENKINS, Director

IN ACCOUNT WITH

Tobacco Research Appropriation

(Public Acts, 1921, Chap. 184)

For the fiscal year ended June 30, 1923

RECEIPTS.

From State Comptroller for vouchers sent by E. H. Jenkins, Director		$5,189.63

EXPENDITURES.

Labor	$1,568.14	
Publications	76.52	
Telephone and telegraph	5.20	
Team and horse hire and carting	279.24	
Water	5.00	
Photographic supplies	3.50	
Miscellaneous supplies	9.73	
Fertilizer	871.54	
Tools, machinery and appliances (new purchases)	317.10	
Travel	46.11	
Surveying	36.50	
Buildings (new) (part of tobacco shed)	1,971.05	
Total		$5,189.63

Second Annual Report

OF THE

TOBACCO STATION

For the year ending October 31, 1923.

Introduction.

The Connecticut Tobacco Station has now completed its second year. The method of its establishment is detailed in the First Annual Report, since which time the state funds have been increased and the financial support of the work assured. The cooperative arrangement between the Station and the Connecticut Valley Tobacco Improvement Association has continued to be mutually satisfactory.

The intent and purpose of those instrumental in the establishment of the Tobacco Station was:

A. To provide for intensive research work on tobacco diseases, fertilization, curing and other problems of the industry.

B. To place at the service of the entire industry the best information and advice that is available.

It is the aim of the station to carry out this program as fully and rapidly as possible. The resignation of Dr. Chapman and the difficulty experienced in finding a suitable successor have made the second phase hard to realize but the experimental work has gone forward without interruption. It should be kept in mind that final conclusions may not be hastily drawn from work of this character. Seasons vary, unusual conditions affect results and only after repeated trials is it safe to speak with any assurance. Moreover, a large undertaking of this nature gets under way slowly.

Staff

Dr. G. H. Chapman, who had been in direct charge at Windsor from the beginning resigned on August 1, 1923 to take a commercial position. Due to his energy and ability, the work of this new institution ran smoothly and efficiently. Mr. C. M. Slagg, previously in charge of the Federal tobacco investigations in the Valley took charge in August, 1923 and carried out the plans for the 1923 crop.

Buildings and Equipment

A new curing barn, designed by Dr. Chapman, has been erected and was used for the 1923 crop. This barn is designed to make possible certain experiments on curing, especially as to methods of

ventilation and firing for stalk tobaccos, but as yet there is not sufficient land on which to grow the tobacco necessary.

Before leaving, Dr. Chapman made preliminary plans for a laboratory and office building, but was unable to begin its construction. Mr. Slagg completed the plans and the building is now finished. We are therefore provided with good facilities, not only for laboratory work, but will be able to sort our own tobacco. The laboratory is yet to be equipped. Provision was also made for experiments in "controlled curing", two large chambers having been constructed in the building. A greenhouse will be necessary and may be constructed this coming year.

Field Day

On July 30, 1923, a field day was held at the Station, about five hundred attending. Throughout the day visitors were conducted through the fields and the experiments explained.

Results of Field Experiments Seasons of 1922 and 1923

The nature of the tobacco crop is such that final data are not obtained until the crop has been fermented. In the case of the 1922 crop, this was not completed until a short time before Dr. Chapman resigned, August 1st, 1923, which event greatly delayed assembling the results. In the meantime, the 1923 crop had been harvested and the data taken. It was therefore decided to combine the results for both years, and present the averages in a separate bulletin, which will appear as Number 5 of the Tobacco Station.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

TOBACCO SUB-STATION

WINDSOR, CONN.

Recommendations

For the

Control of Wildfire

(Revised)

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.

Recommendations for the Control of Wildfire.

Wildfire did not cause serious damage in Connecticut and Massachusetts in 1923, probably due to the weather conditions which were unfavorable for its spread. However, we do not believe growers are justified in neglecting any of the control measures practiced in the past. The possible injury from wildfire is well known, and as long as it is present in the region, every precaution should be taken by all growers.

SEED BED.

1. *Seed Selection.*—Select seed plants in wildfire-free fields. At least be sure that the individual seed plants are free from infection. Bagging the seed heads may be useful. Old seed is less likely to be contaminated.

2. *Seed Sterilization.*—If seed infection is suspected, seed should be sterilized with corrosive sublimate or silver nitrate. Formalin is very apt to cause injury and should not be used.

a. *Corrosive Sublimate.* Soak for 15 minutes in a 1 to 1000 solution in a cheesecloth bag. Wash *thoroughly* and spread out to dry. Use for dry sown seed *only.*

b. *Silver Nitrate.* For seed to be sown sprouted, use this treatment, 1 to 1000 for 15 minutes. Wash and dry. Silver Nitrate is probably the best treatment in all cases.

Note. Corrosive Sublimate and *Silver Nitrate* are both *poisons* and should be handled with great care.

3. *Location of Beds.* Do not use refuse from tobacco sheds or tobacco stems as fertilizer in the seed bed. If possible locate the seed beds on land where there was no wildfire the previous year, and where there has been no opportunity for contamination by drainage from tobacco shed or other refuse.

4. *Sterilize the Beds.* Sterilize the soil with steam at 100 lbs. pressure for 30 minutes, or with formalin 1-50 at the rate of one half gallon to the square foot. It is safer to sterilize the walks also. Spring sterilization is safer than fall sterilization.

5. *Sterilize the Sash.* Boards, sash, and cloth used in seed beds should be drenched with formalin, 1-50. New sash, plank, or cloth need not be sterilized.

6. *Spray or Dust the Plants.* Keep the plants covered with copper lime dust or a copper spray, such as *Bordeaux mixture,* at all times from the stage when they are as large as the finger nail until setting is completed.

7. *Watering.* Adopt a system of bed management which will keep the leaves wet for no longer periods than is necessary to produce good plants.

8. *Disease in Beds.* If the disease appears in isolated spots in the bed, these spots along with a broad margin of healthy plants should be killed by drenching with 1-10 formalin. The sash must be left off the bed for several hours after application of the formalin; otherwise the enclosed fumes will kill or injure seedlings for a considerable distance from the original place of application.

9. *Planting.* Pull plants for setting only from disease-free seed beds. Do not use plants which have stood over night after pulling. Water a long way ahead of pulling, so that the plant leaves will be as dry as possible. Remember that the wildfire germs can be carried on the hands, clothing, tools, sash, etc., and avoid such chances. Wildfire may be readily carried into a clean field by walking through it after having walked through a diseased field.

FIELD.

10. Do not top dress fields with stalks or refuse from badly diseased crops.

11. Do not work in a field where there is any wildfire while the plants are wet.

12. Make frequent inspections as soon as the plants begin to grow in the field, and remove all diseased plants.

13. When the infection is light, removal of the diseased leaves at intervals of three or four days will reduce the number of centers of spread, and may materially reduce the amount of wildfire damage to the crop.

14. Destroy the second growth of suckers after the tobacco is harvested. These often become badly diseased and furnish an unnecessary possible source of infection.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 28

March 20, 1924.

WINTER CONDITION OF APPLE AND PEACH BUDS

By G. P. CLINTON and E. M. STODDARD, Botanists.

The possibility of winter injury to fruit buds, particularly of peaches, was expressed to the Station authorities by certain fruit growers at a recent conference. It was thought that this injury might have resulted not so much from excessive cold, since the temperature has been very low this winter in very few places in the State, but as the after-effects of the unusually dry summer and fall. The Station has been looking into this matter, both through the examination of apple and peach buds in the general region of the Station by Mr. Stoddard and Dr. Garman, and also through the cooperation of various growers over the State, who have kindly made an examination of their orchards at its request. The results of these examinations are set forth in detail here.

APPLES

The observers are all agreed that there has been no special winter injury to apple fruit buds so far as they have been able to ascertain. It is more difficult, however, to get exact data at this time of year with the apples than with the peaches, as the buds are smaller. Some think that possibly the buds are smaller than usual, due to the dry summer. Where there was a heavy crop of apples last year, especially with certain varieties, as Baldwin, there is a light set this year which, however, appears all right as far as it goes. Three growers complained of partridges or pheasants eating off the buds of certain varieties near the woodlands.

PEACHES.

There is undoubtedly considerable injury to the peach buds. This is most pronounced in the northern half of the State, as might be expected, and is least apparent near the Sound. In some places elevation seems to have had an effect, as the trees on the higher hills or slopes are more injured than those lower down. The yellow peaches are, as usual, injured more than the white. Those most seriously injured seem to be the Late Crawford, Hale

and Elberta. Some growers, however, report very little injury even to these, so that if conditions are very favorable at pollinization time and later, there will be a small to fair crop in most orchards and a good crop in a few. With most of the other varieties the outlook at present is for a fair to a good crop. We estimate that there can be a 25% winter injury of peach fruit buds and still a good crop result. However, if in addition to this, later conditions are very unfavorable, this injury becomes more important.

As some growers may be interested in the results obtained on different varieties or in different parts of the State, we append the data obtained by varieties arranged alphabetically.

Arp. 5–15% dead, Experiment Station Farm, Mt. Carmel, Stoddard.

Belle. 60% dead, Washington Depot, Hallock; 37%, Storrs, Hollister; 30-40%, East Longmeadow, Bilton; 25% Greenwich, Drew; 25%, Deep River, Spicer; 20%, Seymour, Coleman; 5-20%, Wallingford (Barnes), Stoddard.

Carman. 65% dead, Washington Depot, Hallock; 30-40%, East Longmeadow, Bilton; 30%, Farmington (Root), Stoddard; 15%, Seymour, Coleman; 5-10%, Southington (Rogers), Stoddard; 8%, Storrs, Hollister.

Champion. 70% dead, Greenwich, Drew; 50%, Washington Depot, Hallock; 30-40%, East Longmeadow, Bilton; 34%, Storrs, Hollister; 5-20%, Wallingford (MacDonald), Stoddard; 10% Seymour, Coleman; 5-15%, Mt. Carmel, Station Farm, Stoddard; 5-15%, Milford (Platt), Stoddard.

Elberta. 98% dead, East Longmeadow, Bilton; 95%, Washington Depot, Hallock; 75%, Seymour, Coleman; 70% high elevation, 30% lower down, 20% low elevation elsewhere, Middlefield, Lyman; 62%, Storrs, Hollister; 50-75% Southington (Rogers), Stoddard; 50%, Greenwich, Drew; 30-50%, Farmington (Root), Stoddard; 35%, Cannondale, Warncke; 25%, Deep River, Spicer; 15%, Wallingford, Barnes; 5-20%, Wallingford (MacDonald), Stoddard; 5-15%, Mt. Carmel, Station Farm, Stoddard; 5-15%, Milford (Platt), Stoddard; 5%, Branford (Cook), Stoddard.

Fox. 30-40% dead, East Longmeadow, Bilton.

Greensboro. 30-40% dead, East Longmeadow, Bilton; 25% Deep River, Spicer; 17%, Storrs, Hollister.

Hale. 75% dead, Storrs, Hollister; 50-75%, Southington (Rogers), Stoddard; 56%, Seymour, Coleman; 45%, Greenwich, Drew; 5-15%, Mt. Carmel, Station Farm, Stoddard.

Hiley. 10% dead, Greenwich, Drew.

June Elberta. 31% dead, Storrs, Hollister.

Late Crawford. 75% dead, Greenwich, Drew; 60-75%, old trees, 35-50%, young trees, Southington, Rogers; 56%, Storrs, Hollister.

Lola. 5-15% dead, Mt. Carmel, Station Farm, Stoddard.

Mayflower. 5-15% dead, Mt. Carmel, Station Farm, Stoddard.

Mountain Rose. 71% dead, Storrs, Hollister.

Nectar. 54% dead, Storrs, Hollister; 30-40%, East Longmeadow, Bilton.

Rochester. 5-10% dead, Southington (Rogers), Stoddard.

Stump. 25% dead, Deep River, Spicer; 15%, Wallingford, Barnes.

Slappey. 54% dead, Storrs, Hollister.

Waddell. 27% dead, Storrs, Hollister; 25%, Deep River, Spicer.

Yellow St. John. 64% dead, Storrs, Hollister.

General Data. 50% dead, Norwich, Browning; 40-50% dead on old trees of white varieties, little injury on young trees of white varieties, Southington, Rogers; 50% dead on yellow varieties but only 25% on white, Farmington, Root; 10% dead on white varieties, Branford, Stoddard; a little injury to Crawford but none to Elberta, Meriden, Ives; Elberta hurt a little but Hiley and Belle of Georgia with heavy set, Hazardville, Billings.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 29

March 22, 1924.

DORMANT SPRAYS FOR ORCHARD PESTS.

W. E. Britton, Philip Garman, Entomologists,
G. P. Clinton, Botanist.

San José Scale. May be present on the bark of twigs and branches under small circular gray shells about two millimeters in diameter. Each sucks the sap. Later in the season the scales appear on leaves and fruit. There are four generations each season. Spraying the dormant trees with miscible oil, 1 part in 15 parts water, with liquid lime-sulphur (1-9), or dry lime-sulphur as directed by the manufacturer, is recommended.

Tent Caterpillar and Fall Canker Worm. The eggs of the tent caterpillar are now present as dark-colored cylindrical masses on the small twigs, covered with a glue-like coating. Those of the fall canker worm are in compact circular, rectangular or irregular masses on the bark of the larger branches. There is some evidence to show that lime-sulphur will kill the young tent caterpillars if applied just before hatching.

Other Insects. Aphid eggs are oval black and shiny objects on the new growth or around the fruit spurs. Eggs of the false or light apple red bug and of leaf hoppers are imbedded in the bark. The bud moth lives through the winter in inconspicuous cases fastened to the twigs around the buds, and the Oriental peach moth, which is present in Fairfield and New Haven Counties, hibernates in similar manner, usually nearer the base of the trees. These last mentioned pests are difficult to destroy in this condition and probably the dormant sprays will not seriously affect them. Some of the aphid eggs will be killed by the dormant spray, lime-sulphur being more effective than miscible oils.

European Red Mite. Owing to the favorable period for development of the pest last summer, apple orchards should be scouted this year, if not already done, for winter eggs of the European red mite. Should these be found in numbers (present on branches one to two inches in diameter and numerous enough so that the

branches appear red in color) prepare to treat with miscible oil. If you are not planning a complete spray program for the summer months, it will probably be best to use oil even if the eggs are few in number. Scalecide or Sunoco spray oil, diluted 1 gallon in 15 gallons of water, are recommended. Use fresh material if possible or make sure that the contents of each can or barrel are thoroughly mixed and that the material emulsifies completely when placed in the spray tank.

A casual examination of seven apple orchards in the central part of the State showed that two were heavily infested, two with a moderate infestation, and the remainder with few or no eggs. Towns in which the worst infestations were seen were Milford and Farmington.

Fungi. These carry over on the twigs both through the Mycelium and the spores. The latter often show as more or less conspicuous pustules. Some of the common fruit diseases that winter over in or on the twigs are the scab, brown rot and leaf curl of peaches, and the fire blight, sooty blotch, black rot, and possibly scab, of pears and apples. So far dormant spraying for fungous troubles has not been very effective except in the case of peach leaf curl. In this case the lime-sulphur treatment given for San José scale is effective.

Spray the trees lightly, but thoroughly, and avoid drenching. Make your application as soon as the buds begin to swell noticeably or show green at the tips.

If you are not sure that your orchard is infested, communicate with us and if possible send suspected material for examination.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 30

March 26th, 1924.

INFORMATION ABOUT INSECTICIDES AND FUNGICIDES.

G. P. Clinton and E. M. Stoddard, Botanists,
W. E. Britton and Philip Garman, Entomologists.

FUNGICIDES.

Bordeaux mixture. Recommended for use on potatoes, muskmelons, grapes, cucumbers and seedbed tobacco,—sometimes for pink and prepink spray on apples. Fresh home-made mixtures are most effective, though commercial preparations are often used successfully. Either stone or hydrated lime may be used. Spray should contain 4 lbs. lime and 4 lbs. copper sulphate in each 50 gals. water.

Lime-sulphur, dormant or winter strength. Recommended for use on apples (dormant or delayed dormant), peaches (late dormant), and pears (delayed dormant) for control of peach leaf curl and such insects as San José scale, pear psylla, blister mite and aphis. Strength 1 gal. lime-sulphur in 9 gals. water. Dry lime-sulphur may be substituted at the strength recommended by the manufacturer.

Lime-sulphur, summer strength. For use as a general fungicide on apples and as an insecticide for control of the European red mite. Usual strength applied, 1¼ gals. to 50 gals. water. Dry-lime-sulphur may be substituted with good results.

Dry mix, self-boiled and **"atomic" sulphur.** Successfully used on peaches. Strengths recommended: *dry mix*, 8 lbs. superfine sulphur, 4 lbs. hydrated lime, and one-half lb. calcium caseinate to each 50 gals. water; *self-boiled lime-sulphur*, 8 lbs. stone lime, 8 lbs. sulphur, to each 50 gals. water; *"atomic"* or *"colloidal" sulphur*, 5 lbs. to each 50 gals. water.

Dusts. Sulphur dusts are satisfactory for use in control of peach scab and brown rot. Pure dusting sulphur is recommended and should be as fine as possible to obtain.

INSECTICIDES

Miscible oils. Valuable for control of the European red mite when used as a late dormant spray as the buds swell; will also kill scale insects. Strength recommended 1 gal. in each 15 gals. of water. Scalecide or Sunoco spray oil are suitable. Do not use on peach trees.

Lead arsenate. Used for control of chewing insects such as canker worm, codling moth, apple and thorn skeletonizer, Colorado potato beetle and others. The dry form of the arsenate is preferable, but the paste may be used. In each 50 gals of water use 1½ lbs. of the dry powder or 3 lbs. of paste.

Calcium arsenate. Should not in general be used on fruit trees, because of danger of burning the leaves,—but may be used on potatoes for control of the Colorado potato beetle; 1 lb. in 50 gals. water is the proper dilution. Sometimes used in dust form on apple trees.

40 per cent. nicotine sulphate. Recommended for control of red bug, aphis or other sucking insects, at the rate of ⅜ to ½ pint to each 50 gallons of spray. Commercial preparations are known as Black Leaf 40, Halls Nicotine, and N. P. C. Nicotine Sulphate.

Dusts. Nicotine dusts are successful in control of sucking lice on vegetable crops and the arsenical dusts may be used on fruit trees. Sulphur-arsenate dust may be used on apple varieties that are not subject to serious scab infection.

SPREADERS.

Any product containing soluble casein and lime, 1 part of casein to 3 parts of lime, may be used to increase the adhesiveness of the above sprays. The most widely known product now on the market is sold under the trade name "Kayso".

CAUTION.

If necessary to combine such sprays as nicotine sulphate, lead arsenate and lime-sulphur, combine in the following order: 1. lead arsenate, 2. nicotine sulphate, 3. casein lime, 4. lime-sulphur.

Oil sprays should be thoroughly mixed before dilution, and should not be used unless a complete emulsion is formed. Do not apply in freezing weather.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 31

March 28, 1924.

WHY AND HOW TO SPRAY.

G. P. Clinton and E. M. Stoddard, Botanists,
W. E. Britton and Philip Garman, Entomologists.

THE WHY.

To get a high percentage of perfect fruit is the aim of the intelligent fruit grower. To attain this, proper control measures for the various fungous and insect pests are very important, and succeed best when the following points are taken into consideration:

Know your troubles. One must determine as accurately as possible what pests will probably attack the fruit before planning the spray schedule. The Experiment Station will gladly assist in this determination. After determining your common troubles remember that arsenical poisons, as arsenate of lead, control chewing insects and must be applied before or soon after they start feeding; that contact poisons, as nicotine sulphate, control sucking insects and must be applied to the insects themselves; that fungicides prevent but do not cure injuries by fungi and so must be applied before infection takes place.

Know your varieties. Varieties vary in susceptibility to different injuries especially fungous, and it is important to know the troubles to which each variety is subject. As, for instance, scab is bad on McIntosh, and red mite is most serious on Baldwin. A Bulletin of Immediate Information will follow this, giving a list of the most injurious fungous diseases on the apple varieties commonly grown in the State.

The environment. Environmental conditions are often determining factors in the severity of injury. Dry or moist localities cause variation in fungous attacks. In the case of cedar rust, nearness to cedars is the important consideration. Many insects are worse on trees near to woodland or brush and rubbish along fences. The age of the trees, the method of cultivation and pruning, the location as to air drainage and extreme temperatures are also important factors. The latter, as regards winter injuries, is not subject to control by spraying.

THE HOW.

The material. Use the materials recommended for the particular pests to be controlled. Usually several materials are combined to control more than one pest in a single application. (See Bulletin of Immediate Information No. 30, Insecticides and Fungicides.)

The machinery. Use a spray outfit to fit the work at hand and do not expect a worn out machine to give the best results. Do not wait until the outfit is in the orchard to find out what is the matter with it—know beforehand and fix it. Many growers are turning from the spray gun to the rod and nozzles and we believe this is good sense unless experienced men are handling the gun. High pressure is the latest notion, but we contend that excessive pressure frequently wastes material and causes injury, and that 200 lbs. or less, with proper nozzles will do the work. Clean the spray tank frequently.

The method. Make your sprayings thoroughly and timely. This does not mean drenching the bottom and missing the top, but just enough to cover all over, inside and out. Do not wait until the aphids have curled the leaves so that the spray will not reach them.

The weather. For control of fungi try to plan the spraying ahead of a storm, especially the early sprays for scab. This prevents the spores from germinating on the tender young leaves. Most sprays will stick if they may dry an hour before it rains. Avoid spraying in high winds and do not dust in more than a gentle breeze—better no breeze at all. With the late summer sprays do not apply them during very hot periods, preferably doing the work in the morning or late afternoon, to avoid burning of the foliage.

Number of treatments. The number of treatments will depend on the pests to be controlled—usually five or six as a maximum and three as the minimum, for fungi. In most seasons we cannot control apple scab with less than five sprayings, but varieties that do not scab can be handled with three, the calyx and two later sprays, unless some other pest becomes serious, when an extension of the schedule is necessary. Insects, especially chewing insects, can be controlled with one or two sprayings even if applied after they appear, but fungi must be controlled by spraying before they get a start and the plants need to be protected with a spray coating during the entire season of their infection, which means more careful and frequent sprayings.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 32

April 10, 1924.

VARIETAL SUSCEPTIBILITY OF APPLES TO DISEASES AND INJURIES.

G. P. CLINTON, Botanist.

Some varieties of apples suffer more from certain fungous diseases than do others in the same orchard. When experience shows this as a common trait with the variety, we say that it is very susceptible to the disease. Such, for example, is evidently the case of Fall Pippin and McIntosh with relation to Scab, and of the Wealthy to Rust. The same thing holds true with regard to certain of the injuries, or so-called *physiological* troubles, not due to either fungi or insects. For example, Bitter Pit (locally known as Baldwin Spot), is most serious on the Baldwin Apple, and Water Core on the King.

Some of these troubles, especially those not due to fungi, are not controlled by spraying, while Spray Leaf Burn and Fruit Russet are the direct outcome of spraying. Most of them, however, yield more or less completely to intelligent spraying. It behooves the grower, then, to know beforehand what are the troubles in his orchard, and what varieties are especially attacked. With this idea in view we compiled a list of apples more commonly grown in the state, and from our experience listed the diseases and injuries found most frequently on them. We then submitted this list to about forty apple growers for their opinion. The list that follows is based upon the combined data obtained.

Pick out from the list the varieties grown by you and note the diseases that more commonly occur; then spray with reference to them. Watch your apples the coming season and acquaint yourself definitely with the troubles of each variety. Insects are more general in their attacks, so we have not included them here, but it is just as important that you know what insects are common in your orchard, and include them in your fight for good fruit.

In this list we have printed in *italics* the non-parasitic injuries, and have listed these and the principal diseases under each variety in the order of their importance as near as we could. In general it can be stated that the four worst diseases of apples in this state

are: Scab, Brooks Fruit Speck, Rots (all kinds), and Sooty Blotch; and the three most serious injuries are: Winter Injury, Bitter Pit and Spray Russet.

Astrachan—Brown and Black Rots (bad), Scab.
Baldwin—*Bitter Pit* (bad), Brooks Fruit Speck (bad), *Spray Russet* (bad), Sooty Blotch, *Winter Injury*, Scab (little).
Ben Davis—Rust, Scab, *Spray Russet.*
Crabs—Scab (bad), Rust.
Delicious—Scab, Rust.
Duchess—Brooks Fruit Speck, Bitter Rot.
Early Harvest—Scab.
Fall Pippin—Scab (bad), Fire Blight.
Fallawater—Rust.
Fameuse—Scab (bad), Sooty Blotch.
Gravenstein—Rot, Scab, Brooks Fruit Speck.
Greening—Sooty Blotch (bad), Scab (bad), *Spray Russet* (bad), Blue Mold and Black Rots, Fire Blight.
Hubbardston—Rust, Brooks Fruit Speck, Scab, *Bitter Pit.*
Hurlbut—Black Rot, Brooks Fruit Speck, *Bitter Pit*, Fire Blight.
Jonathan—*Jonathan Spot* (bad), Rust, Brooks Fruit Speck.
King—*Water Core* (bad), Brooks Fruit Speck, *Barrenness.*
McIntosh—Scab (bad), Black Rot.
Northern Spy—Brooks Fruit Speck (bad), Scab, Sooty Blotch.
Opalescent—Scab, Brooks Fruit Speck, Fire Blight.
Peck's Pleasant—Rust.
Pound Sweet—*Water Core*, Brooks Fruit Speck, Scab.
Rome Beauty—Scab, Rust.
Russet—Rust.
Stark—Bitter Rot, Sooty Blotch, *Bitter Pit.*
Sutton—Rust, Scab.
Tolman Sweet—Sooty Blotch, *Bitter Pit*, Brooks Fruit Speck.
Wagener—Brooks Fruit Speck, Limb Canker.
Wealthy—Rust (bad), Brooks Fruit Speck.
Winter Banana—Rust.
Wolf River—Rust, Black Rot, Scab.
Yellow Transparent—Scab.
York Imperial—Rust.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 33

April 15, 1924.

THE PRE-PINK AND PINK SPRAYS FOR APPLES.

G. P. Clinton, Botanist, and M. Zappe, Entomologist.

What are the Pre-pink and Pink Sprays? These are the two sprayings made fairly close together, if both are applied, between the dormant spray and the calyx spray. In other words they are semi-dormant to semi-summer sprays. They are applied usually between the last of April and the middle of May. The first is given when the fruit buds are just beginning to break through their enclosing leaves, and the second when the blossom buds are far enough advanced to show a decided pink color, but with none of the blossoms yet open. If the weather is favorable for rapid bud development they may be made within a week of each other; or the pre-pink may be made even earlier, near the delayed dormant as pictured by Darrow in his Spraying Bulletin (Extension No. 70) if there has been no dormant spray.

Why Used. Formerly these sprays, or at least the pre-pink, were not used to any great extent. To-day they are coming into more general use for a certain fungus on a variety susceptible to its attack, and for definite stages in the life history of a few insects. If this fungus or these insects do not trouble you in your orchard, then these sprays may be omitted.

When necessary for Fungi. Dormant or semi-dormant sprays are usually of little value for fungi in general. It may be that sooty-blotch is cleaned off the twigs to some extent, and that some spores of the black rot are killed, but for these alone it is very doubtful if these sprayings would be financially profitable.

With scab the benefits are much more evident. The reason for this is that on the young developing leaves the scab gets its first start. So far as we now know scab does not hold over to any great extent on the twigs, but depends for infection upon the mature stage that has developed on the old leaves on the ground. This stage begins to shoot its spores into the air about the time the young leaves are breaking through the buds, and the first or primary infection then takes place. If the scab gets a good start on these young leaves it is much more difficult to control later,

hence the necessity of keeping them fairly well protected from the time they begin to emerge from the buds until the calyx spray is put on. So far as apples are concerned the pre-pink and pink sprays need be used only on those varieties that are quite susceptible to scab. See Bulletin of Immediate Information No. 32.

When Necessary for Insects. The pre-pink and pink sprays are not as important for controlling insect pests as some of the later sprays. The European red mite and aphids may be controlled in both the pre-pink and pink sprays if they have not all been killed by the delayed dormant spray. Aphids if present at this time can usually be found on the new leaves and have not yet caused the leaves to curl around them. After the leaves are curled it is much harder to kill them with any spray.

There are a number of leaf-eating insects that begin to feed as soon as leaves appear. The most important ones are the larvae of the bud-moth, canker-worm, tent caterpillar and apple and thorn skeletonizer. Some of them spend the winter as larvae and are ready to begin to feed early. Others hatch from over-wintering eggs and the young begin to feed as soon as the foliage starts to grow. The pink rather than the pre-pink is the most important of these two applications for the control of leaf-eating insects.

What Sprays to Use. If you are spraying only for scab use the summer strength of a fungicide, namely, about 3 gallons of liquid lime-sulphur to 100 gallons of water, or the 8-8-100 Bordeaux mixture. There is not much danger of spray-burn or russet from the Bordeaux at this time. If insects are to be included in your control, nicotine sulphate can be added for the aphids and European red mite, and arsenate of lead for the leaf-eating insects. Nicotine sulphate is used at the rate of three-fourths of a pint, and lead arsenate (dry) 3 pounds to 100 gallons of the fungicide, or of water if the former is unnecessary.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 34

April 21, 1924.

SPRAY FOR THE IMPORTED CURRANT WORM.

B. H. Walden.

Nearly every spring the foliage of currants and gooseberries is injured by the imported currant worm, *Pteronidea ribesi* Scop. Often the owner does not notice the pest until many of the plants are partially stripped. This insect came from Europe nearly seventy years ago.

The adult is a four-winged fly, the female being about one-third of an inch long, with the head and thorax nearly black and the abdomen yellow. The male is somewhat smaller with a black abdomen.

The flies appear about the middle of April or soon after the foliage is well started, and lay rows of eggs along the veins on the under side of the leaves. The eggs are about one-twentieth of an inch long, nearly white in color, and hatch in about seven to ten days. The young worms are at first white in color, but soon change to green. After the first molt the worms are green, spotted with black. They become full grown in two to three weeks and are about three-fourths of an inch long when they descend into the ground and spin brown cocoons under leaves or rubbish. In late June or early July the adults of a second brood appear. The winter is passed in the cocoon stage.

TREATMENT.

The currant worm is a comparatively easy insect to control. As soon as the eggs begin to hatch, spray the plants thoroughly with lead arsenate, using $1\frac{1}{2}$ pounds of the powder to 50 gallons of water, or one ounce to a gallon for small quantities. Double the amount for paste. The application should be repeated in about one week to protect the leaves that have developed since the first treatment. Any of the dusts containing lead arsenate can be used in place of the spray if more convenient. These treatments

should protect the foliage from serious injury. If, however, it is necessary to give a treatment after the fruit is two-thirds grown, fresh *hellebore* should be used instead of lead arsenate, using two ounces to one gallon of water, or as a dust by mixing one pound of hellebore with five pounds of air-slaked or hydrated lime. While hellebore, if fresh, will readily kill the currant worms, lead arsenate is preferable for the early treatments as it will stick better to the foliage and remain effective for a longer time.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 35

April 25, 1924.

TREE WORKERS HOLDING CONNECTICUT CERTIFICATES.

TREE PROTECTION EXAMINING BOARD.

W. E. BRITTON, Entomologist, *President:* G. P. CLINTON, Botanist, *Vice-President:* W. O. FILLEY, Forester, *Secretary-Treasurer.*

The Station is frequently asked to suggest someone to prune, repair or spray trees. In doing so merely as an accommodation, the Station neither implies guarantee of satisfaction nor seeks to advertise the business of any person or firm. However, the list at the end of this bulletin includes those who have qualified under the state law and hold certificates issued by the Tree Protection Examining Board. This law is as follows:

AN ACT CONCERNING THE IMPROVEMENT, PROTECTION OR PRESERVATION OF FRUIT, SHADE OR ORNAMENTAL TREES.

Chapter 181. *Public Acts of* 1919. (In effect July 1, 1919.)

SECTION 1. No person, firm or corporation shall advertise, solicit or contract to improve the condition of fruit, shade, forest or ornamental trees, by pruning, trimming or filling cavities, or to protect such trees from damage by insects or disease, either by spraying or any other method, without having secured a certificate as specified in section two of this act; and any person, firm or corporation failing to comply with the terms of this act shall be fined not more than one hundred dollars; provided any person may improve or protect any tree on his own premises or on the property of his employer or on any property within the limits of the town of which he is a legal resident, without securing such a certificate.

SEC. 2. The botanist, entomologist and forester of the Connecticut Agricultural Experiment Station shall constitute a board which shall, upon application from any person, firm or corporation, examine the qualifications of the applicant to improve, protect or preserve fruit, shade, ornamental or forest trees, and if satisfied that the applicant is qualified, may issue a certificate so stating; which certificate shall be valid for one year from the date of its issue, unless sooner revoked as provided in section three of this act, and may be renewed by the board for succeeding years without further examination, upon payment of the fee hereinafter required, provided any person, firm or corporation receiving such certificate shall be responsible for the acts of all employees in the performance of such work.

SEC. 3. Said board shall prepare all necessary forms and prescribe all rules and regulations governing examinations, and any certificate issued under the provisions of this act may be revoked by it upon proof that improper methods have been used or for other sufficient cause.

SEC. 4. Each applicant for an examination shall pay a fee of five dollars in advance, and a fee of two dollars for each certificate or renewal issued; which fees may be expended by the board for any expense incurred by it in making examinations or issuing certificates, and an account of all receipts and expenditures under this act shall be rendered annually to the state comptroller.

Under this law no one may carry on such a business outside of his own town unless he holds a certificate.

Up to this time 100 original certificates have been issued. A few have been cancelled and several have not been renewed. There has been one prosecution of a man who solicited and performed work without a certificate, in violation of the law. Property owners are respectfully requested to notify this Board of anyone suspected of operating in violation of the law.

The following list gives the names and addresses of those persons and firms engaged in tree work who now hold certificates from this Board. Changes will occur as some fail to renew and examinations are held from time to time and new names are added. In general it is best for a property owner to employ some one in his locality, as it saves traveling expenses. Particularly if he knows one personally or by reputation and has confidence in his work, he should employ that man or firm. If he is not familiar with such work and is unacquainted with all on the list, he can readily make inquiries regarding those nearest his property and thus make a selection. Some of these men, in addition to their tree work, are also nurserymen and landscape architects. The list follows:

FIRMS AND INDIVIDUALS HOLDING CERTIFICATES.

Name	Address	Cert. No.	Certificate Expires
Armstrong Tree Service, Ltd....	Poughkeepsie, N. Y.		
Armstrong, Newton G.....	" "	86	May 25, 1924
Parmelee, Leland E.....	" "	89	Jul. 23, 1924
Baldwin, Thos. J.....	P. O. Box 176, Guilford, Conn.....	21	Jul. 15, 1924
Bartlett Tree Expert Co., F. A. (F. A. Bartlett).....	Stamford, Conn.....	10	Jul. 15, 1924
*Barton, Robert.....	P. O. Box 57, Hamden, Conn.....	66	Dec. 18, 1924
Beaupain & Saunders (Henry F. Beaupain).....	So. Norwalk, Conn..	27	Aug. 12, 1924
Bellétti, Peter J.....	R. F. D. No. 2, Naugatuck, Conn...	41	Nov. 6, 1924
*Bertolf Brothers (August C. Bertolf).....	Sound Beach, Conn..	24	Jul. 29, 1924
Brown, Edgar M.....	211 Sisson Ave., Hartford, Conn.....	52	Jun. 6, 1924
Calverley, Arthur.....	763 Campbell Ave., West Haven, Conn..	97	Mar. 31, 1925

* Is also a nurseryman.

Name	Address	Cert. No.	Certificate Expires
Cardarelli, Emilio J.....	Cromwell, Conn.....	57	Feb. 28, 1925
Clark, Harry E.....	Middlebury, Conn...	72	Mar. 8, 1925
Clark, Wyllis S.....	New Canaan, Conn..	20	Jul. 15, 1924
Clyne, G. A.....	73 Canal St., Waterbury, Conn....	5	Jul. 1, 1924
Condon Co., Maurice L. (Maurice L. Condon).....	Lake Mahopac, N. Y.	46	Feb. 2, 1925
Cromie, George A.....	18 Compton St., New Haven, Conn...	88	May 25, 1924
Davey Tree Expert Company,..	Kent, Ohio.		
Baldwin, H. E.....	Gen'l Delivery, Norwich, Conn.....	91	Jul. 23, 1924
Gammie, Peter.....	P. O. Box 423, Stamford, Conn.....	60	May 26, 1924
Grove, D. Q.....	Kent, Ohio.....	87	May 25, 1924
†Desmond, Thomas H.....	Simsbury, Conn.....	50	Apr. 4, 1925
DeWolfe, John C. G.....	85 Medford St., Medford, Mass.....	80	Aug. 7, 1924
Easton, Clifford H.....	P. O. Box No. 1, Scarborough, N. Y...	53	Jun. 16, 1924
*Elm City Nursery Co.....	New Haven, Conn...	7	Jul. 1, 1924
*Ernst, Otto F.....	Norwich, Conn.....	79	Jul. 14, 1924
Fertsch, Ross L.....	P. O. Box 220, Newburgh, N. Y....	84	Apr. 4, 1925
Galligan, Clarence W.....	15 Admiral St., Allingtown, Conn....	74	Jun. 28, 1924
Gibbs, R. M.....	33 Fairfield St., Pittsfield, Mass.....	83	Apr. 4, 1925
Gilbert, J. E.....	376 George St., New Haven, Conn...	61	May 26, 1924
†Goodwin Associates, James L.,	750 Main St.,		
Goodwin, James L.....	Hartford, Conn.....	39	Nov. 26, 1924
Pettee, Edward E.....	" "	38	Nov. 6, 1924
Graf, Albert H.....	P. O. Box 87, Bardonia, N. Y.....	67	Dec. 18, 1924
Grovit, Albert.....	986 Whalley Ave., New Haven, Conn...	85	Apr. 6, 1925
Gustafson, Harry A.....	P. O. Box 81, Watertown, Conn...	96	Mar. 25, 1925
Hartford Forestry Company....	65 Sherman St.,		
Hansling, Philip, Sr.....	Hartford, Conn.....	17	Jul. 15, 1924
Hansling, Philip, Jr.....	" "	16	Jul. 15, 1924
*Herthal, G. F.....	228 Bunnell St., Bridgeport, Conn....	25	Jul. 29, 1924
Herthal, Gus., Jr.....	228 Bunnell St., Bridgeport, Conn....	36	Sept. 17, 1924
Hollister, S. P.....	Conn. Agr. College, Storrs, Conn.....	47	Mar. 21, 1925
*Hunt & Co., W. W. (W. A. Wright).....	167 Blue Hills Ave., Hartford, Conn.....	33	Sept. 17, 1924
Kellner, Arthur H.....	7 Grove St., So. Norwalk, Conn..	26	Aug. 12, 1924
*Kellner, Herman H.....	Danbury, Conn.....	101	Apr. 1, 1925
*Kelley, James J.....	New Canaan, Conn..	19	July 15, 1924
Landscape Foresters Ltd. (C. E. Mager).....	52 Vanderbilt Ave., New York City.....	32	Sept. 17, 1924

* Is also a nurseryman.
† Is also a landscape architect.

Name	Address	Cert. No.	Certificate Expires
*†Mallett Co., G. A. (George A. Mallett)	95 Catherine St., Bridgeport, Conn	11	Jul. 15, 1924
Maynard, Eugene	61 Coit St., New London, Conn	94	Feb. 6, 1925
McLaughlin & Carberry, Carberry, Joseph V.	Sharon, Conn	78	Jul. 9, 1924
McLaughlin, J. A.	" "	77	Jul. 9, 1924
Meader Co., L. H. (Lewis H. Meader)	75 Westminster St., Providence, R. I	31	Sept. 17, 1924
*Millane Tree Expert Co. (Neal A. Millane)	Middletown, Conn	1	Jul. 1, 1924
Morris, Harry H	9 Winthrop Place, Danbury, Conn	40	Nov. 6, 1924
Munson-Whitaker Co. (Robert O'Shea)	1 Washington St., Boston, Mass	42	Nov. 25, 1924
Old Colony Forestry Co. (Thomas J. McGinnis)	415 Savin Ave., West Haven, Conn	4	Jul. 1, 1924
Pauley Tree Expert Co. (George A. Pauley)	New Canaan, Conn	22	Jul. 29, 1924
Perry, Lewis	Southington, Conn	95	Feb. 6, 1925
Plumb, C. K. & J. C. (C. K. Plumb)	New Canaan, Conn	100	Mar. 31, 1925
Pool, William H	47 Sheffield Ave., Roslindale, Mass	63	Oct. 10, 1924
Rice, Ralph S	Care of Y. M. C. A., New Haven, Conn	69	Dec. 18, 1924
Rich, Nehemiah L	101 Warren St., Stamford, Conn	3	Jul. 1, 1924
*Rockfall Nursery Co. (Philip Marotta)	Rockfall, Conn	71	Mar. 8, 1925
Rottenberg, Julius	Newington Gardens, Newington Jct., Conn.	93	Jan. 9, 1925
Royal Forestry Co. (Charles Vallett)	124 Division St., Waterbury, Conn	62	Aug. 5, 1924
*Schoonman, W. J	New London, Conn	6	Jul. 1, 1924
Shaw, Walter	494 Blake St., Westville, Conn	55	Jun. 16, 1924
*Sierman C. H	2291 Albany Ave., W. Hartford, Conn	8	Jul. 1, 1924
*Steck, Harold W	Newtown, Conn	92	Jan. 10, 1925
*van Heinigen, Jacob C	So. Wilton, Conn	48	Apr. 4, 1925
van Kleef, Marinus	Bridgewater, Conn	75	Jul. 4, 1924
*Van Wilgen Company	71 Main St.,		
Van Wilgen, A. C	Branford, Conn	99	Mar. 31, 1925
Van Wilgen, W	" "	98	Mar. 31, 1925
*Verkade, H	Cor. Crocker St. and Lower Boulevard, New London, Conn	18	Jul. 15, 1924
Wilcox, Reginald C	Essex, Conn	30	Sept. 17, 1924
Wright, John L	P. O. Box 593, Putnam, Conn	43	Nov. 25, 1924

* Is also a nurseryman.
† Is also a landscape architect.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 36

May 1, 1924.

THE CALYX AND LATER SUMMER SPRAYS FOR APPLES

E. M. STODDARD and M. P. ZAPPE.

The *pre-pink* and *pink* sprays have been outlined in Bulletin of Immediate Information No. 33, and in this bulletin the *calyx* and later summer sprays will be discussed.

For convenience of reference, we will designate the calyx spray as summer treatment No. 3 (pre-pink and pink being Nos. 1 and 2 respectively) and the later treatments will be numbered in succession. As the formula for all of these sprays is the same except such additions as will be noted we will give the formula used and recommended by this Station.

Dry Arsenate of Lead.....1½ lbs. to 50 gals. water.
Spreader..... ½ lb. to 50 gals. water.
Liquid Lime-sulphur.....1½ gals. to 50 gals. water.
(Dry Lime-sulphur can also be used with equally good results if preferred, following the directions of the manufacturer for dilutions.)

SUMMER TREATMENT NO. 3.

The calyx treatment should be put on immediately after the petals fall while the calyx cup is still turned up and open. This treatment is the most important insect spray on the schedule and depends on its timeliness for its efficiency. The principal insect to be controlled is the *codling moth*, but other important ones are *canker worms, apple and thorn skeletonizer* and *tent caterpillar. European red mite* will be controlled by the Lime-sulphur in this spray and if *aphis* and *red bug* are present, nicotine sulphate can be added at the rate of three-fourths pint to 100 gallons. We do not include the nicotine in the formula as oftentimes it is unnecessary and it adds materially to the cost of the mixture.

This spray is necessary in the control of *apple scab* but is not very efficient unless the pre-pink and pink sprays have been given. *Black rot leaf spot* is also controlled by this spray.

Summer Treatment No. 4.

Use the same formula as No. 3 and apply two weeks later. For leaf eating insects and late scab infection.

Summer Treatment No. 5.

Same formula as before and put on first week in July. For apple and thorn skeletonizer, apple maggot, fruit speck and sooty blotch.

Summer Treatment No. 6.

Same as No. 5 and applied the last week in July. For second brood codling moth, apple maggot, fruit speck and sooty blotch.

Notes.

Nos. 5 and 6 should not be put on when it is excessively hot nor at extra high pressure, as foliage injury is likely to result.

Nicotine sulphate may be added to the last two treatments if leaf hoppers are prevalent.

Extra sprays immediately following the calyx for the control of curculio have not been recommended as their value is somewhat doubtful. In recent work at this Station, there are indications that these sprays may be of benefit, not so much from the poison as by the repellant action of any material that is on the fruit.

We do not feel safe in recommending dust for control of apple troubles, but if one wants to use it, the same schedule may be followed.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 37

May 3, 1924.

PEACH SPRAYING

E. M. Stoddard and M. P. Zappe.

Fungous and insect troubles are not as numerous on peaches as on apples and a schedule of one dormant spray of liquid Lime-sulphur 1 to 9 for scale and leaf curl, and three summer treatments of spray or dust will usually give good control of the important fruit and foliage troubles.

It has been our experience that dusting will give as good results as spraying for the summer treatments, but so far we cannot recommend dust as a dormant treatment.

Schedule of Summer Treatments.

No. 1.	When shucks have fallen.
No. 2.	Three weeks after No. 1.
No. 3.	Three to four weeks after No. 2.
Note.	Brown rot is more difficult to control than scab. In very wet seasons a fourth treatment about three weeks before the fruit ripens is desirable.

Any one of the following materials may be used for the summer treatments:

Atomic Sulphur.

5 lbs. to 50 gallons.

This is a ready mixed commercial material in paste form which mixes readily with water, and gives uniformly good results under Connecticut conditions.

Dry Mix Sulphur-lime.

8 lbs. sulphur.
4 lbs. hydrated lime.
½ lb. casein spreader.
50 gallons water.

The dry ingredients are mixed together and washed through the strainer while the tank is being filled with water. This mixture was originated at the New Jersey Station and has given good results on peaches in that state.

SELF-BOILED LIME-SULPHUR.

8 lbs. sulphur.
8 lbs. stone lime.
50 gallons water.

The sulphur is sifted into the slaking lime and allowed to cook by the heat of the lime for fifteen minutes, then diluted and strained into the spray tank.

DUSTING SULPHUR.

In our experiments we have used sulphur dust without lime or lead arsenate. This has given good results in the control of brown rot and scab, and no injury has resulted. Our experience with arsenical poisons on peaches does not warrant us in recommending their use, as injury often results, and our data show that curculio are not appreciably controlled.

PEACH BORER.

The peach tree borer is doubtless present in every peach orchard in the state. It is a white grub found in the trunks of the trees at or near the soil level, its presence being indicated by masses of gum and wood particles. These grubs reach the adult stage between July and September and the female moths begin laying eggs soon after emerging. These eggs hatch in about ten days and the young borers begin entering the trees at once.

The use of *paradichlorobenzene* is supplanting the old method of "worming" in the control of this pest. The paradichlorobenzene treatment is as follows:

Clear all rubbish from around the base of the tree and put three fourths to one ounce of the material on the soil in a circular band about two inches from the trunk of the tree. *It should never touch the tree.* Cover the material with soil, free from rubbish, to a depth of four or five inches. This mounding of the soil is important because the chemical is effective only to the height of the soil on the tree. Make the application about September 15th. Do not use paradichlorobenzene on trees under three years of age. On trees from three to six years old the material should be removed after three weeks, but on older trees it may be left indefinitely.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 38

May 15, 1924.

GRAPE SPRAYING.

G. P. CLINTON and E. M. STODDARD.

In view of the fact that grapes are becoming an increasingly important crop in Connecticut a few suggestions for the control of fungous and insect pests seem desirable. The spraying of grapes has an especial interest because the first spraying to be done for the control of fungi was made for black rot on grapes in France. Also the experiments of Thaxter in Connecticut in 1889 for the same disease were among the earliest in this country.

BLACK ROT.

Black rot is the chief disease of grapes in Connecticut. It causes first a brown rot on the green fruit and finally the characteristic black shriveled berries, often destroying the entire crop in wet seasons if no control measures are used. It also affects the stems and leaves. On the stems it does very little damage, but on the leaves it produces more or less extended brown spots in which are the fruiting bodies that spread the disease during the summer. The mummied grapes and infected stems carry the disease over winter and furnish a source of infection the following season. On this account the vines should be thoroughly pruned each year and the rubbish burned. The mummied fruits should also be removed as much as possible each fall and destroyed. The year following severe attacks of black rot special attention should be given to spraying.

BITTER ROT.

Bitter rot is a fungous disease, somewhat similar to black rot in its effect on the fruit, and occasionally does damage. The spray schedule for black rot will take care of it.

Mildews.

Downy and *powdery mildew* are fungous diseases of lesser importance which attack the foliage and fruit of grapes. The downy mildew produces a whitish tufted growth on the under surface of the leaves and causes a brown rotting of the fruit. The powdery mildew occurs chiefly on the upper surface of the leaf as a cotton-like growth. Neither requires treatment other than that given for black rot.

Spray Schedule.

No. 1—When leaves are small (about the middle of May.)
No. 2—Just before blossoming.
No. 3—Soon after blossoms fall.
No. 4—Two or three weeks later (according to weather.)
No. 5—Two or three weeks after No. 4.

Note—Do all spraying *very* thoroughly.

Use Bordeaux mixture 4-4-50 for all the sprayings with the addition of lead arsenate in the earlier ones *only*, for leaf eating insects if abundant. If the rot has been bad the previous year a delayed dormant treatment may be necessary and if the season is wet more sprayings after No. 3 are desirable. *Do not spray after August 1st* as the spray will show on the ripe fruit. In the later sprays the addition of a casein spreader is advised as the Bordeaux adheres rather poorly to the fruit.

Spraying with self-boiled lime-sulphur has been used with some success as a repellant for *rose chafers*.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 39

May 17, 1924.

THE APPLE AND THORN SKELETONIZER.

W. E. Britton.

This European insect was discovered in this country in Westchester County, New York, in 1917. It appeared in Connecticut at Greenwich and Stamford late in 1920, has now spread all over southern New England, and is present in northern New Jersey and in the Hudson River Valley of New York State at least as far north as Albany.

There are three generations each year, and the insect passes the winter in the adult stage (as a moth). The first moths this season were observed flying in New Haven on April 10. Larvae of the first generation will feed upon the apple trees the last half of May and first part of June; those of the second generation during July, or from late June to early August; the third generation larvae from late August up to about the middle of October.

The eggs are mostly laid singly on the under surface of the leaves, often beside the mid-rib or a large vein, and the egg-laying period is extended over two or three weeks. The eggs hatch about a week after being laid and the tiny larvae eat away small patches from the under surface, then go to the upper surface of the leaf where they spin a light web across the leaf, fastened at the opposite edges. Under this web the larva feeds upon the leaf tissue, often devouring all except the lower epidermis and the veins; and becoming full grown in about three weeks.

A white cocoon is then made, usually in a fold or along the mid-rib of a leaf, about three-fourths of an inch long and pointed at both ends. In about two weeks the moth emerges.

Further information may be obtained about this insect by consulting Bulletin No. 246 of this Station.

Control Measures.

Commercial orchards are usually properly sprayed and are not injured by this pest. Unsprayed trees may be completely de-

foliated and seriously weakened. Fruit trees around the home are prized both for their shade and for their fruit and should by all means be given the attention which they deserve.

The usual spray schedule, providing for a number of applications of lead arsenate will control the apple and thorn skeletonizer. Even where trees are not injured by the first generation of larvae, the second or third may defoliate them. From one to one and one-half pounds of dry or powdered lead arsenate in fifty gallons of water, sprayed upon the leaves is effective. The sprays should be applied when the larvae are just beginning to feed rather than when they are ready to make their cocoons. The approximate dates of these applications are: May 15 (or calyx spray), July 1, and August 10.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 40

May 20, 1924.

SPRAYING SHADE TREES.

W. E. BRITTON.

Shade trees are sprayed during the summer months for the purpose of controlling various chewing and sucking insects which attack the foliage and occasionally to prevent injury from fungous diseases. By far the most common reason for spraying is to control certain chewing insects.

CHEWING INSECTS.

Elm Leaf Beetle: Over-wintering beetles eat holes in leaves during May and deposit on the under sides of the leaves clusters of yellow eggs which hatch about June 1, and the grubs feed on the under surface, skeletonizing the leaves, which in severe attacks turn brown and fall about July 15-20. Only elm trees are attacked. The remedy is to spray the under surface of the leaves thoroughly during the first week in June with lead arsenate, using 2-3 lbs. of the dry powder in 50 gallons of water. In all of the sprays it is advisable to add two pounds of calcium caseinate for a spreader.

Canker Worms: Eggs hatch with the unfolding leaves and the larvae feed upon the leaves of all kinds of deciduous trees. Spray with lead arsenate by the middle of May or as soon as there is enough leaf surface to catch and hold the poison.

Tent Caterpillar: Over-wintering eggs hatch with the unfolding leaves and caterpillars make nests or webs in the crotches of trunk and branches, and devour the foliage. Apple and wild cherry are the common food plants, but when exceptionally abundant as is the case this season, oak and other trees may be attacked. Spray about May 15 with lead arsenate.

White-Marked Tussock Moth: Curious and striking tufted caterpillars devour the leaves of various fruit and shade trees during June and August, there being two broods each year. These caterpillars have bodies striped lengthwise with brown and yellow and with red heads. There are four tufts of white or yellow hairs on the back, two pencils of black near the head and one on the tail. Spray with lead arsenate.

Other Tussock Moths: The hickory and tessellated tussock moths also feed upon shade trees the last half of summer but are seldom sufficiently abundant to need treatment.

Fall Web-Worm: White webs near the ends of the branches in late summer show the presence of this insect, which attacks all kinds of fruit, shade and

forest trees, often defoliating them. Applications of lead arsenate in August will prevent injury.

Walnut Caterpillar: Hickory, black walnut and butternut trees are attacked and often entirely defoliated by white-haired blackish caterpillars, which feed in clusters. Spray with lead arsenate in August.

Pine Sawflies: Several species of sawfly larvae feed upon the various pine trees which are now planted for shade and for ornament. Trees are occasionally defoliated, causing serious injury. Spray with lead arsenate as soon as larvae are noticed.

Other Caterpillars: Many other insects, such as gipsy moth, various leaf rollers, birch leaf skeletonizer, etc., feed upon the foliage of shade trees and may be controlled by a spray of lead arsenate.

SUCKING INSECTS.

Various species of aphids suck the sap from the leaves of nearly all kinds of shade trees. Conspicuous examples are the woolly beech aphid of the copper or purple leaf beech, the yellowish green aphids on birch trees and the green aphid on Norway maple. Aphids usually occur on the under sides of the leaves and give off a sweet sticky substance called "honey dew" which drips upon the lower leaves and upon the ground appearing like a coating of varnish. A black fungus or sooty mold grows in the honey dew, which looks as though covered with soot.

The proper treatment is to spray the under sides of the leaves with nicotine sulphate, one-half pint in 50 gallons of water. Either a pound of calcium caseinate or two pounds of dissolved laundry soap should be added as a spreader.

The woolly maple leaf scale can best be controlled by spraying the trunk and base of the larger branches of infested trees in March or April with liquid lime-sulphur (1 to 9) as for San José scale. The same treatment should be given tulip trees as soon as the leaves drop in autumn to kill the newly hatched tulip tree scales.

LEAF FUNGI.

These are about the only fungi that are controlled by spraying and fortunately comparatively few are injurious enough on our shade trees to warrant this attention. Among the most prominent and injurious of these are the Leaf Blotch of the European Horsechestnut, and the Anthracnoses of Maples, Oaks, Poplars, Ash and Sycamores. Less frequent and injurious are the Leaf Spots of the Elm and the English Hawthorne. Spraying for any of these troubles should begin before the first sign of spots appears on the leaves; for the anthracnoses this means as soon as the young leaves begin to break through the buds. The treatments should be repeated at least twice at intervals of two or three weeks according to the weather. Bordeaux Mixture of the home-made 4-4-50 strength is the best fungicide, though commercial forms can be used to less advantage, at the strength recommended. Stewart, of the Cornell Experiment Station, found that dusting with finely ground sulphur was effective in controlling the Leaf Blotch of the Horsechestnut. In yards it is desirable to rake together and burn in the fall the leaves of this tree or, better still, put them in the compost pile.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 41

May 20, 1924.

THE ORIENTAL PEACH MOTH.

Philip Garman.

The Oriental peach moth is due to appear shortly in peach orchards in southwestern Connecticut. A close watch should be kept for it in fresh, rapidly growing shoots, the attack usually beginning when the shoots are about an inch long. Such shoots are tunneled by the young larvae which pass to another twig after they have eaten a half inch to an inch of the core. The larvae themselves are most commonly found in freshly wilted twigs. When the tree stops growing and the twigs harden, the larvae enter the peaches to feed, the natural result of this habit being a heavier infestation in late ripening peaches than in early varieties.

The eggs are laid singly on the underside of the leaves, often some distance from the tips of the twigs, and resemble codling moth eggs, though somewhat smaller, being flat and closely applied to the surface. In fact, the whole life history is similar to that of the codling moth, except for twig feeding habits of the larvae, and the number of generations, which in Maryland and Virginia number four in all, with sometimes a partial fifth. In Connecticut there are possibly three generations only, but the dates when they will appear cannot be stated with certainty. The first generation will doubtless appear at the time of the shuck-fall spray, when the first twig injury should be noticed. This will probably be about June first.

Distribution.

The Oriental peach moth has been recognized as occurring in Fairfield, New Haven and Hartford Counties. In other States it has been found in quince and apple (fruit) but so far it has only been seen in peach twigs and fruit in Connecticut.

Control.

Two factors prevent satisfactory control. The first is the habit of the larvae of rejecting the first few mouthfuls when entering a new shoot, or a peach; the second is the very rapid growth of the

peach tree when the insects are multiplying most rapidly, preventing a complete coating of arsenical or other poison. The only points of attack remaining are the egg and pupal stages, the latter being passed in small silken cocoons hidden in crevices on the bark, under bark scales or on the ground. The over-wintering larvae may often be found on the trunks of the trees near the ground, similar to the codling moth. So far there is no treatment known which is effective in killing the hibernating larvae or the pupae.

About 70 per cent. of the eggs, however, may be killed with nicotine sprays, and, if timed correctly, have proven successful in controlling infestations in Virginia. The first of these sprays should apparently be given at the shuck-fall application and may be added to the regular sprays for curculio and fungous control. It is also the belief that many of the first brood larvae will pick up considerable poison at this time and be killed. The dilution of the nicotine used should be about 1 part in 800, or one-half pint in 50 gallons. Nicotine sprays for later broods are also necessary, but the exact time for this application has not been determined for Connecticut.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 42

June 10, 1924.

SPRAYING POTATOES.

G. P. CLINTON, Botanist.

Spraying potatoes against fungous diseases has made slow progress in this State. The reasons for this slow progress are three fold: the potato is not a main crop, on which farmers depend for their chief income; there are few very large growers who can be depended on to set the pace; and last, late blight, the chief reason for spraying, does not cause wide-spread loss every year. However, each year sees more Connecticut farmers growing potatoes on a commercial scale, and these men are, almost without exception, spraying thoroughly and with profit.

Long continued experiments in New York, New Jersey and Connecticut prove beyond doubt that thorough, consistent spraying pays, every year, especially on late potatoes. Aside from protection from late blight, spraying with a fungicide helps in a minor way to lessen loss from early blight and tip-burn, and, when combined with insecticides, gives adequate protection against the Colorado beetle and leaf hopper, and moderate control of the flea beetle and aphis.

In this state late blight rarely if ever appears before the middle of July, so that spraying would not need to start before that time were it not for the fact that this is a little late for the control of the insect pests and the early blight, and for the further fact that when started this late it is usually impossible to coat thoroughly the lower parts because of the heavy growth of the vines at this time. For these reasons we advocate the starting of the spraying when the plants are six to ten inches high.

For a small acreage, a barrel pump may be mounted in a wagon. A boom is easily attached or the spray may be applied with lines of hose. Commercial growers find it much more profitable to use traction or power sprayers specially designed for potatoes and similar crops. When the vines are small, one nozzle will cover a row but for later sprayings, three nozzles are essential. Several satisfactory traction sprayers are now on the market.

Low pressure is often a cause of poor spraying. The gauge should never drop below 150 lbs. for good results, and 200 lbs. is better still. Successful potato spraying depends not only on beginning early, but also on thoroughness. Keep the foliage coated. A single nozzle per row will not cover, and lines of hose, while effective, make the labor cost too great. The high pressure machine with three nozzles per row is the only satisfactory rig for large areas.

Spraying should be repeated every ten days to three weeks according to the weather conditions and rapidity of growth of the foliage. Keep the foliage coated at all times, and especially see that it is particularly well coated before a rain. If one can spray and have the spray dry on just before a rain, this is particularly desirable. Under these conditions it will take from five to seven sprayings with a traction sprayer to thoroughly protect a field of late potatoes during the season. Ridging the rows early in the season helps to make driving through the field easier and with less injury to the vines. It makes for better coating of the foliage, favors more rapid evaporation of moisture from the vines, and protects the tubers more thoroughly from infection by burying them deeper in the soil.

We recommend only home-made 5–5–50 Bordeaux mixture for potato spraying. To this can be added 3 lbs. of lead arsenate paste, or 1½ lbs. of the dry form, for the first two or three treatments as needed for the control of insects. Farmers are reluctant to make their own Bordeaux mixture despite the fact that it is cheaper and more efficient than the commercial forms. However, where the home-made mixture is impossible, use the commercial forms at the strength recommended. Some growers in other states have had good results with dusting, but our results so far here are much less satisfactory than with spraying.

Home-made Bordeaux can be made as follows:

5 lbs. Copper Sulphate (Blue Vitriol).
6 lbs. Fresh Lime.
50 gallons Water.

Note—Low magnesia lime leaves less sediment and does not wear out the discs so rapidly as high magnesia.

For small acreage. Dissolve the copper sulphate in hot water. Slake the lime and strain through coarse cheese-cloth. Dilute each separately to 25 gallons. Pour together slowly through a strainer into the spray barrel.

For large acreage. Made stock solutions of copper sulphate and lime as follows: Dissolve 50 lbs. of copper sulphate in 50 gallons of water, by suspending in a grain sack. One gallon of stock solution thus contains one pound of copper sulphate. Slake 60 lbs. of lime, strain into a barrel and make up to 50 gallons. The excess takes care of waste in slaking. Put two 50-gallon dilution barrels on a platform so that the sprayer can be backed under them. For a 100-gallon sprayer put 10 gallons of stock lime solution into the lime barrel and 10 gallons of stock copper sulphate solution into the copper sulphate barrel. Dilute each to 50 gallons. By using a molasses spigot for each barrel, the two streams may be run together through a trough into the sprayer. A large fine wire strainer should be set in the sprayer opening. Lead arsenate, Paris green, or nicotine solution may be added if needed. Hydrated lime is handy to use, but Bordeaux made with it is said by some not to adhere so well.

Some growers get good results with the following method: Start filling the sprayer with water, washing in at same time 10 gallons of the stock lime solution through the strainer. When half full, add the 10 gallons of stock copper sulphate solution with the remaining water, stirring meanwhile. When short handed this method saves time. Half of these amounts are used for a 50-gallon sprayer.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 43

June 16, 1924.

THE APPLE MAGGOT OR RAILROAD WORM.

W. E. Britton

The apple maggot or railroad worm, *Rhagoletis pomonella* Walsh, is a serious pest of apples in Connecticut. The maggot tunnels in the ripening fruit, causing it to decay. It usually attacks the less acid and early maturing varieties, often rendering the fruit worthless. In certain seasons it also infests the late maturing and acid varieties like Greening and Baldwin. Sweet and subacid varieties are commonly attacked and the fruit ruined by this insect.

This is a native American insect which formerly bred in the wild thorn and in blueberries and huckleberries. The adult is a two-winged fly, with dark cross bands on the front wings, which emerges early in July and feeds for two or three weeks on drops of moisture on the leaves and fruit before laying eggs. The female has a sharp ovipositor with which she punctures the skin of the fruit and lays an egg in the pulp, just beneath the skin. This egg is whitish and elongated and hatches in from two to six days, when the young maggot begins to tunnel through the pulp of the fruit. They make little headway until the fruit ripens and becomes soft, then they increase rapidly in size and the injured fruit decays, the pulp becoming a brownish spongy mass. Sometimes the tunnels extend close to the skin and show from the outside, but in other cases there is no external evidence that the fruit is infested, though on cutting open, it may be found worthless. When mature the maggot leaves the apple and goes about an inch into the soil and pupates. There is probably a partial second brood, and development may proceed in fruit in storage if the temperature is sufficiently high.

Control Measures.

Formerly it was recommended that all drops be gathered and destroyed and that late cultivation be practiced to kill the pupae in the soil. Now it is known that spraying the trees with arsenate of lead (1 to 2 lbs. of the dry powder in 50 gallons of water) during July will prevent serious injury from this pest, as the flies feed upon the poisoned moisture on the foliage and are killed before they lay eggs. One application should be made about July 4th or earlier for early varieties, and another about July 25th, or three weeks after the preceding application.

Some Connecticut orchardists are already spraying several times after the trees blossom. Thus the apple maggot spray given the first week of July will control the second brood of the apple and thorn skeletonizer, and the second treatment should control the second brood of codling moth.

In case later applications are made to control sooty blotch on winter varieties, lead arsenate may also be included as an additional protection against the apple maggot.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 44

July 15, 1924.

THE GIPSY MOTH QUARANTINE.

W. E. Britton, *State Entomologist.*

The Federal Horticultural Board has recently revised the Federal quarantine (effective July 1, 1924) on account of the gipsy moth, to include the Connecticut towns of Cornwall, North Haven, Branford, North Branford, Guilford, Madison, Clinton, Killingworth, Durham, Haddam, East Haddam, Lyme, Chester, Saybrook, Westbrook, Essex and Old Saybrook, not included in the Federal quarantine of 1923. As the State quarantine had not been revised since 1922 (see quarantine Order No. 4), it seemed advisable to make it correspond with the Federal quarantine. Consequently after due notice as provided in Section 2106 of the General Statutes, a hearing was held at Hartford on July 9, 1924, and the subject fully discussed. There was no opposition expressed and the following quarantine order was issued:

STATE OF CONNECTICUT

Agricultural Experiment Station.

New Haven, Conn.

QUARANTINE ORDER NO. 6.

Concerning Gipsy Moths.

In order to protect uninfested parts of Connecticut from danger of infestation by the gipsy moth, under authority given in Section 2106 of the General Statutes, the following regulations are hereby established.

1. The following towns are hereby placed under quarantine because of the gipsy moth:—

HARTFORD COUNTY:

Avon	Farmington	Plainville
Berlin	Glastonbury	Rocky Hill
Bloomfield	Granby	Simsbury
Bristol	Hartford	Southington
Burlington	Hartland	South Windsor
Canton	Manchester	Suffield
East Granby	Marlborough	West Hartford
East Hartford	New Britain	Wethersfield
East Windsor	Newington	Windsor
Enfield		Windsor Locks

LITCHFIELD COUNTY:

Barkhamsted	Harwinton	Plymouth
Canaan	Litchfield	Salisbury
Colebrook	New Hartford	Thomaston
Cornwall	Norfolk	Torrington
Goshen	North Canaan	Winchester

MIDDLESEX COUNTY:

Chester	East Hampton	Middletown
Clinton	Essex	Old Saybrook
Cromwell	Haddam	Portland
Durham	Killingworth	Saybrook
East Haddam	Middlefield	Westbrook

NEW HAVEN COUNTY:

Branford	Madison	Wallingford
Cheshire	Meriden	Waterbury
Guilford	North Branford	Wolcott
	North Haven	

NEW LONDON COUNTY:

Bozrah	Ledyard	Old Lyme
Colchester	Lisbon	Preston
East Lyme	Lyme	Salem
Franklin	Montville	Sprague
Griswold	New London	Stonington
Groton	North Stonington	Voluntown
Lebanon	Norwich	Waterford

TOLLAND COUNTY:

Andover	Ellington	Tolland
Bolton	Hebron	Union
Columbia	Mansfield	Vernon
Coventry	Somers	Willington
	Stafford	

WINDHAM COUNTY:

Ashford	Hampton	Scotland
Brooklyn	Killingly	Sterling
Canterbury	Plainfield	Thompson
Chaplin	Pomfret	Windham
Eastford	Putnam	Woodstock

These same towns have already been quarantined by the Federal Horticultural Board of the United States Department of Agriculture, and it shall be unlawful to remove from this quarantined area any woody nursery stock, lumber, cordwood, telegraph or telephone poles, railroad ties, or other forest plant products, unless the products shall have been inspected and certified by an authorized State or Federal inspector.

2. In view of possible future changes in the lines between the infested and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the United States Department of Agriculture: furthermore the regulations established by the Federal Horticultural Board of the United States Department of Agriculture for inter-state shipments, are hereby adopted for the inspection and certification of similar shipments from the quarantined area to points outside of this area within the State of Connecticut.

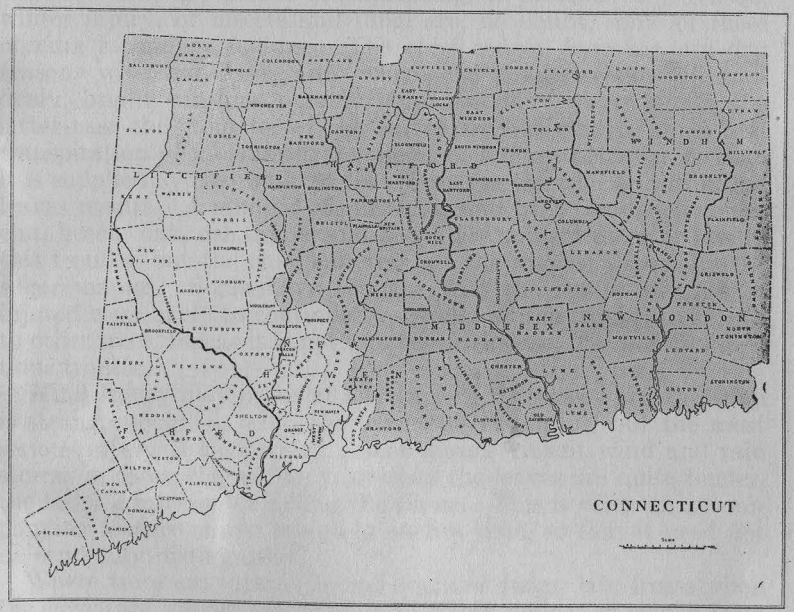
3. This order shall take effect from its date.

Dated July 20, 1924.

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

Approved:

CHARLES A. TEMPLETON,
Governor.



The quarantined area is shown on the accompanying map, and includes the following towns not covered in quarantine order No. 4: Cornwall and Litchfield in Litchfield County; Cheshire, Wallingford, Meriden, North Haven, Branford, North Branford,

Guilford and Madison in New Haven County; Middlefield, Durham, Haddam, East Haddam, Killingworth, Clinton, Westbrook, Chester, Saybrook, Essex and Old Saybrook in Middlesex County; Lyme and Old Lyme in New London County.

All woody field grown nursery stock and forest products to be shipped from the quarantined area into the free area must be inspected by a State or Federal inspector and certified. All frequent shippers should procure a Federal map showing the quarantined area, the location and address of each Federal inspector and the area covered by him. These maps may be obtained from Mr. D. M. Rogers, 408 Atlantic Avenue, Boston, Mass.

An arrangement has been made by which inspections can be made by both State and Federal inspectors. Applications for inspection should be made to the nearest Federal Inspector or to:

D. M. Rogers, 408 Atlantic Ave., Boston, Mass., in charge of Federal inspection service; or

W. E. Britton, State Entomologist, Agricultural Experiment Station, New Haven, Conn., in charge of State inspection service.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 45

July 19, 1924.

SUN SCORCH, ANTHRACNOSE, ETC., OF SHADE TREES.

G. P. Clinton

SUN SCORCH AND WHIPPING WIND INJURIES.

Injury from Sun Scorch varies greatly in different seasons, but usually comes on suddenly and generally in the spring rather than later in the season. There are various conditions that favor this trouble and these are not always easily made out, so that in a row of street trees one sometimes finds trees badly scorched, and others in varying degrees up to little or no scorch. Injury to the roots or wood through recent transplanting, a previous dry season, winter injury, or insects and fungi are, no doubt, some of these obscure secondary factors. The chief causes, however, are dry seasons with hot days, and, where the trouble comes on suddenly, bright sunshine quickly following rainy weather. In the latter case the stomates of the leaves are likely to be open and transpiration of moisture from the tissues takes place faster than it is supplied by the roots, so that scorch at the edge or within the leaves results. A number of our shade and fruit trees such as the elm, beech, oak, ash, apple and peach are subject more or less to this trouble, but the chief sufferers are the maples, especially the sugar maples. Some have thought that the leaves of trees so injured were likely to continue to scorch and the trouble to spread to other trees, but as it is not a parasitic disease, it is not an infectious trouble.

Wind Injury may occur at any time of the year when the wind is strong enough to whip the leaves off the limbs, but the most serious injury is that which comes during violent wind and rain storms in the spring of the year when the leaves are quite tender, the lashing injuring or killing the tissue. This is often an accompanying feature of sun scorch at such a time, so that it need not be especially distinguished.

Where trees are injured by anthracnose fungi, late frosts when the leaves are young, gas leaks from street mains, or smoke from brick kilns, it is not always easy to distinguish these leaf injuries from the sun scorch trouble, especially on maples, since the leaves die in very much the same manner from the edges inward; evidence for any of these other causes must be looked for.

Maple. The maple trees in many places, especially in New Haven County, were injured this spring by sun scorch. Some

drop of leaves took place, but most of the injured leaves hung on and will show the red dead areas at their edges during the remainder of the season. In some cases the injury to the rootlets from the severe drought of last year no doubt favored this scorch. However the chief factor seemed to be their exposure on hills, etc., to the full force of a whipping wind and rain storm about May 24th, that was followed the next day by bright sunshine. This occurred before the leaves were fully grown.

Other Trees. We have seen no serious injury to other trees from scorch this year unless the trouble on beech is partly due to that rather than the anthracnose. Apple and pear trees, however, in some places showed minor injury from whipping winds when the leaves were young, turning them black at the edges.

ANTHRACNOSES.

These are fungous troubles that usually cause injury to the leaves or young twigs in the spring. While different trees may have a distinct fungus, the injuries resulting are much the same, as are the preventive treatments. In general the trees should be sprayed with Bordeaux mixture as soon as the leaves begin to develop, and have two or more subsequent treatments at intervals of about two weeks.

Sycamore. The anthracnose (*Gloeosporium nervisequum*) of this tree was unusually abundant this year, due to the cold wet spring that held back the rapid growth of the leaves, so that abundant bud infection often killed the leaves before they had made much growth. As a result everywhere in the state the native sycamores showed an unusually scanty foliage. After killing the small leaves and buds, the fungus works down into the young twigs where it fruits and becomes a serious source for infection another year if the weather conditions prove favorable. These trees therefore should receive also a dormant spray just before the buds open. The European sycamore is not so susceptible to the disease, and young American sycamores show less than the older trees because twig infection has not become so common. Badly infected trees usually put out some additional leaves which escape serious infection.

Oak. White oaks also were more or less injured by an anthracnose fungus (*Gloeosporium canadense*) this year. This is very similar to the sycamore anthracnose, but causes injury more on the mature or nearly mature leaves. However, we found it in some cases killing the very young leaves in the buds and fruiting on the stems.

Beech. For the first time we found an anthracnose fungus *Gloeosporium Fagi* var. *Americana*) on the beeches, especially on the Purple Beech, but not causing serious injury in most cases.

Maple and Ash. These trees also have anthracnose fungi that cause more or less injury to the leaves, though this year we had few complaints.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 46

July 26, 1924.

PREMATURING OF VEGETABLES, ROTS OF LETTUCE AND SIMILAR TROUBLES.

G. P. Clinton and Florence A. McCormick.

The spring and summer of 1924 have so far had somewhat unusual weather conditions. The spring was cold and wet, so that many ornamental plants, fruits and vegetables were very backward in their development. The blossoming period of apples and peaches was quite extended with a good bloom but only a fair set. Peonies were very late in blooming and of short duration. Some growers lost much of their vegetable seed because the conditions favored rot or dampening off. June and July came on warm and dry but with fairly cool nights. As a result of these conditions certain peculiar troubles, especially with vegetables, have developed. One of these is the prematuring, or going to seed, of plants that would not normally do so. The following are the crops of which we have heard complaint.

PREMATURING.

Cabbage. One grower had considerable trouble with cabbage that instead of heading out normally formed small heads and then started to blossom. He had to pull up those heads and feed them to the hogs. While the season, wet early and then dry, was favorable to this development, the fact that the plants were somewhat overgrown and had been held back before set out helped to favor this abnormal development.

Beets. It is expected that seedling beets if re-set may in some degree go to seed instead of continuing to form normal bottoms. The season favored prematuring to an unusual degree since not only re-set beets but also the undisturbed seedlings in some cases showed such a tendency.

Onions. There has been considerable complaint that onions grown from sets formed seed stalks to an unusual degree. Ebenezer or Japanese (considered by some as identical and by others as distinct strains), seem to be the most generally raised by vegetable growers. There apparently has been considerable difference in the production of seed stalks by these onions this year. As a result some growers regard the Ebenezer variety as no longer unmixed, others that it has degenerated and that the Japanese strain is superior, others that the source of the seed is the chief factor, while others that the time of topping and the character of the season have had the most influence. Such onions, if seed stalks are formed commonly, are very inferior since the stalk continues into the bulb as a hard center. Topping when very young is said ordinarily to overcome this trouble. Some growers had onions from two different sources planted on the same land at the same time that showed a marked difference in the formation of seed stalks.

Lettuce. A good summer lettuce seems to be needed in this state, as most of the varieties grown do not do so well in the warm summer weather. One of the difficulties complained of this year was the heads going to seed before they could be marketed. Big Boston gave more trouble in this respect than Salamander.

ROTS AND OTHER LETTUCE TROUBLES.

Basal Rot. There was general complaint of rots of head lettuce grown out of doors this year. The wet spring weather seemed to favor the maximum development of certain soil fungi and bacteria, and while the dry weather of June and July checked the rots, the cool nights still allowed sufficient moisture to collect in the soil under the plants and on the edge of the leaves to continue them less seriously up to the middle of July.

A study of infected plants from a number of growers showed two types of rots. The basal rot starts from certain soil fungi, *Rhizoctonia Solani* or rarely *Pythium deBaryanum*, that gain entrance through the leaves in contact with the wet earth. Ordinarily these do little harm as the infected basal leaves can be stripped off before any general invasion of the head occurs. But the present early wet season favored further infection of the leaves within the head, forming a general red heart rot. The Rhizoctonia mycelium in certain cases could be seen in dense masses entirely destroying the softer tissues. Neither of these fungi form aerial spores so that infection is through contact with the soil only. Both Salamander and Big Boston suffered from this type of rot.

Leaf Edge Rot. The second type of rot seemed to start from the edge of the leaves, probably favored by the moisture that accumulated there during rain or dewy nights, and worked downward more or less irregularly into the head. Such heads often were entirely sound on the outside but when marketed complaint was usually made of interior rot. When broken open irregular larger or smaller areas of reddish brown rotted tissue would be seen. Under favorable moisture conditions these became enlarged into a more general head rot. Even when not conspicuous these rotten areas within the head rendered it of little commercial value, especially in an overstocked market. This type of rot was the more unusual and serious of the two. One grower lost 70% of 100,000 heads of Big Boston from this trouble. In this case our investigations seem to indicate that bacteria were the primary cause of the trouble as they were present in great quantities in the infected tissues where no fungi were seen. Eventually in both this and the basal rot other fungi, bacteria and nematodes occurred in the badly rotted tissues. The liberal use of manure on the land or green cover crops plowed under and not fully rotted would favor this type of bacterial rot. The spread from plant to plant may have been due to insect carriers.

Leaf Burn. Certain heads were seen that showed the exposed edges of the leaves seared inward for a short distance as if sun scorched. Within the tissue sometimes occurred a miscellaneous growth of saprophytic fungi. Whether or not this is a distinct type of injury or merely the arrested condition of the Leaf Edge Rot was not determined.

White Heart. This seems to be entirely a physiological trouble due to the type of lettuce or to the seasonal conditions. Big Boston is subject to it, and develops it most in the warmer season of the year. The heads are formed but instead of being compact, are rolled loosely with the central leaves irregular, whiter and harder. The outer leaves often droop and the lettuce besides being inferior in quality does not stand up well. There was some complaint of this trouble also.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 47

July 26, 1924.

PREMATURING AND OTHER POTATO TROUBLES.

G. P. CLINTON.

PREMATURING AND WILT.

Potatoes and lawns are very good indicators of lack of moisture in the soil, as they show evidence of injury usually before other plants. With a wet, cold, backward spring one would not expect drought to become a serious factor this early in the year were it not a fact that June and July, so far, have been quite deficient in rainfall. As a result most crops are beginning to show the effects of insufficient moisture, and early potatoes are the first to suffer severe injury. The complaint, so far, this year is largely limited to Irish Cobblers.

The potato needs considerable moisture in the soil, especially when it reaches full foliage growth, as the leaves at the tips and margins are not well fitted to retain moisture during very bright warm weather. If water is not supplied to the roots as fast as it is lost by the leaves, either tip burn of the foliage or prematuring of the vines results. This year has been very favorable for the latter trouble, and has caused many to suspect that some unusual disease has been injuring the vines.

The vines when in their prime begin to turn yellow and die down. This dying may be very irregular over the field. It is somewhat similar to natural death, except it occurs too early, and before the tubers have reached their full growth. Sometimes there is a dropping over and partial wilting of the vines before they have lost their green color. This latter character was not very prominent this year, and may be taken as an indication of unbalanced fertilization. During the war, when it was impossible to obtain a sufficient amount of potash salts to make a balanced fertilizer, mixtures were often used that contained no potash, and, especially in 1918, a very dry season caused much trouble similar to the present, except that the wilting was a more pronounced feature. There was also some loss last year from prematuring because of the dry season.

What confuses growers as to the cause of the trouble is that early varieties like the Irish Cobbler go down where Green Mountain or other late varieties, sometimes in the same field, will look all right. This is

simply because the latter have not yet reached the state of maturity that favors prematuring from drought. Prematuring occurs in that stage of the plant when foliage growth has been completed and the plant is bending all its energy in the formation of tubers. This means that a lot of water is used, and when this is deficient in the soil during bright warm weather, the potatoes yellow and die prematurely. Let the drought continue and the late varieties reach the same stage of growth, they will go down in a similar manner. This was what actually happened in 1918.

Some fields premature sooner than others of the same variety, depending on such factors as earliness of planting, amount of humus in the soil, type of soil, and such other factors that lessen moisture in the soil. A gravelly knoll in a field may have the vines on it dead before the rest of the field shows much trouble. Vines at the edge of a field shaded by trees may still be green when those elsewhere are gone. The shading has held back their development.

Most Irish Cobbler fields we have seen are now almost too far gone to be benefitted to any great extent by rain. However where fields are not over half dead there will still be a considerable addition to the tubers before they finally die, especially if the dying takes place slowly. We have seen no serious injury yet to the Green Mountain potatoes. If abundant rain comes before long the late potatoes will pull through. If it comes a little late, they will show the injury partly through a decreased crop and partly through irregular knobs on the large tubers. If the drought continues long enough, they will suffer the same as the early ones have.

OTHER TROUBLES.

Up to the time of the drought potatoes had looked fairly well. In some cases, there had been a little rot of the seed before coming up. Black Leg and Rhizoctonia canker, minor troubles, possibly are somewhat more prevalent than usual. There has also been a little complaint of Scab. Early Blight so far has been inconspicuous, and there is no evidence yet of the Late Blight, as June and July have been too dry for these troubles. Tip Burn has not been conspicuous because we have had few very hot days. Lice have been fairly common in some of the premature fields, but their presence was not the cause of the prematuring though possibly aiding it somewhat. There is some complaint of irregular stands and stunted plants due to Mosaic and related diseases. With better inspection in the seed producing states we may expect this to decrease. Certified seed is the only remedy for these troubles.