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# FRUIT AND VEGETABLE DISEASES ON THE CHICAGO MARKET IN 1935

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These notes and data represent material collected by the writer from personal observations on the condition of fresh fruits and vegetables as they arrived on the Chicago market, and information abstracted from over 2,000 certificates issued by the Inspection Service of the Fruit and Vegetable Division of the Bureau of Agricultural Economics in Chicago. Diagnoses of the diseases listed were either made by the writer or were made under his supervision in collaboration with Mr. E. E. Conklin, Regional Supervisor of Federal Inspection.

During the year, 115,408 cars of fresh fruit and vegetables arrived on the Chicago market. Of this number, 67,343 cars were unloaded and consumed in the Chicago area, and the remaining 48,065 cars were diverted to other cities. Only a small fraction of the total number of cars of fruits and vegetables were inspected, consequently no attempt is made to list all of the diseases present or to estimate the monetary losses sustained. Most of the diseases mentioned are thought to be of general interest and representative of the products inspected. However, rare and unusual diseases are listed when found, either on new hosts or on common crops from new regions.

Crops are listed alphabetically by common names.

APPLES:

In apples from all regions blue mold rot (Penicillium expansum) is by far the most common, and usually the most serious, cause of decay. Even under the best of handling conditions there are enough mechanical wounds and punctures, open lenticels, or areas injured by chemical means to open the way for this ever-present fungus. As a rule, the percentage of decay caused by blue mold is not high, most inspections showing 2 to 5 percent, with an occasional car showing as high as 12 percent of affected fruit. In exceptional instances, such as Idaho Jonathans shipped during October, blue mold rot was found affecting as high as 50 percent of the apples in some lots, and in several cars the average decay ran as high as 15 to 30 percent, the high percentage in these cars being associated with serious chemical injury as a result of washing. For example, a car of apples showing 18 percent blue mold rot also showed 70 percent severe chemical injury.

Chemical injury probably ranked second among the factors affecting the marketability of the 1935 crop. The injuries most common were bleaching by acids and burning by arsenicals, the latter being especially prominent about the calyx. In some instances checking and shriveling, characteristic of excessive heat in washing solutions, was evident. However, in the heavy shipping regions of Washington and Oregon the majority of the crop was washed and marketed without much injury due to the washing processes. The amount of chemical injury in apples from these regions, when found at all, was usually less than 2 percent.

Internal breakdown was found in apples of large size and advanced maturity in stock from many regions, but usually not more than 2 to 5 percent showed this trouble.

Bull's-eye rot (Gloeosporium perennans) was found in a few cars of Yellow Newtown apples from Washington and Oregon when inspected here in April. Decay of this type was noted in one car ranging to as high as 16 percent in some boxes, the average for the car being 6 percent.

Physiological troubles, such as scald, soft scald, water-core and bitter-pit were of slight importance except in occasional lots.

Gray mold rot (Botrytis spp.) was noted in one car of Oregon apples, but was of little commercial significance.

An unusual soft brown watery decay about the calyx and extending inward around the core of some Washington Winesap apples was of special interest. A Sporotrichum was isolated from several specimens showing this decay.

Pansy-spot (Thrip injury) was found on a few Colorado apples of the McIntosh variety.

Pink mold rot (Cephalothecium roseum), following scab, was found seriously affecting a few lots of Michigan apples.

Several cars of West Virginia Romes, taken from storage in January, were found with one-eighth-to one-half-inch brown to black spots about the lenticels. Both Alternaria and Cladosporium were repeatedly isolated from such areas.

ASPARAGUS:

The asparagus received on the Chicago market arrived in very good condition. Bacterial soft rot (Bacillus spp.), affecting about 1 or 2 percent of the stock, was noted in a few lots. Some crates of asparagus from Imperial Valley in California showed a slight amount of moldy tips, caused by a species of Fusarium.

AVOCADO:

The avocados received on the market are generally free from decay, but occasionally *Rhizopus* rot and anthracnose (*Colletotrichum gloeosporioides*) cause some trouble. In April several boxes of California avocados of the Fuerte variety showed the above types of decay, ranging from 5 to 35 percent.

BEANS:

Watery soft rot (*Sclerotinia sclerotiorum*) is usually the most serious decay of green beans on the market. It was found in beans from Louisiana, Texas, California, and New Jersey. While this decay usually ranges between 2 and 10 percent, occasionally a lot showed as much as 50 percent of the beans affected.

Bacterial blight (*Bacterium phaseoli* and *B. medicaginis phaseolicola*) to the extent of 1 to 5 percent was noted in a few lots of Texas beans. The blight from this region appears to be becoming more and more of the halo type.

Russetting and scarring are among the most important marketing factors.

Anthracnose (*Colletotrichum lindemuthianum*) caused a little trouble in green beans from Mississippi. Soil rot (*Rhizoctonia solani*) was also found in beans from Mississippi as well as from Louisiana.

Bacterial soft rot (*Bacillus* spp.) and rhizopus rot (*Rhizopus* spp.) were found affecting beans from all regions. These diseases are common in stock showing excessive mechanical injury and in lots that become too warm during transit.

BEETS:

Bacterial soft rot of the tops of bunch beets is about the only disease of commercial importance. There is seldom any decay of the roots.

BROCCOLI:

This relatively new vegetable has, so far, shown little decay in transit or on the market. Bacterial soft rot (*Bacillus* spp.) in bruised stems and flower heads sometimes occurs to a slight extent.

CABBAGE:

During February, Texas cabbage on the Chicago market showed considerable damage from bacterial soft rot (*Bacillus* spp.). Some cars showed 30 percent of the heads having decay in one to four outer leaves. Black leaf spot (*Alternaria* sp.) also blemished the outer leaves of several car lots.

Bacterial soft rot was also the most important decay in cabbage from California, Florida, Alabama, New York, and Wisconsin, but generally did not run higher than 5 to 10 percent. In one exceptional instance a lot of Alabama cabbage showed a range of 20 to 100 percent, an average of 50 percent of the heads showing this decay following bruises on the outer leaves and at the base of the stem.

Black leaf spot (*Alternaria* sp.) and black leaf speck (non-parasitic) were both prevalent in California cabbage marketed during March and April. California cabbage marketed during February showed a great deal of blemishing by ring-spot (*Mycosphaerella brassicicola*).

Black rot (*Bacterium campestre*) and an associated bacterial soft rot at the stump caused much trouble in Mississippi cabbage shipped during May.

*Peronospora parasitica* was found causing a grayish-black discoloration of the pith regions of occasional heads of Wisconsin storage cabbage marketed in February.

CANTALOUP:

A slight amount of *Fusarium* rot was found in cantaloups from most regions. This decay usually is found at the stem end or blossom end of the fruit.

*Geotrichum* sp. was found causing a brown watery decay about the blossom and stem ends of one lot of California cantaloups marketed in June. The writer had not observed this fungus causing decay in cantaloups previously.

CARROTS:

As now packed and refrigerated, bunch carrots show little decay on arrival at market. There is an occasional lot that has a small percentage of bacterial soft rot, largely due to heating. Watery soft rot (*Sclerotinia sclerotiorum*) and gray mold rot (*Botrytis*), which sometimes cause serious decay during transit and storage, were not conspicuous on the Chicago market.

CAULIFLOWER:

Bacterial soft rot, following mechanical injury to the flower head, is usually the most important disease of this crop on the market. Occasionally a somewhat similar decay, induced by Alternaria brassicae, affects some lots of cauliflower during transit and marketing, but this trouble was not of great significance during the year. Such blemishes as yellowing of the jacket leaves and spreading and riceyness of the heads are usually among the most important marketing factors.

CELERY:

Watery soft rot (Sclerotinia sclerotiorum) and bacterial soft rot caused most serious decay in celery from all regions. Many lots noted showed 3 to 25 percent watery soft rot, and one exceptional car had 75 percent of the celery bunches affected by this disease.

Neither late blight (Septoria spp.) nor early blight (Cercospora apii) were of great consequence except in one interesting case, when a lot of California celery showed 25 to 75 percent bacterial soft rot in the leaves and top branches, generally following late blight.

Cracked stem (physiological) was extremely damaging in many cars of Florida celery shipped during March. At one time three car loads were rejected on account of this serious blemish. Brown stem also caused much trouble in a few cars of Florida celery shipped during April.

CHICORY:

Brown and black discolorations of the margins of the heart leaves caused most serious trouble to this product. In some lots bacterial soft rot followed in the discolored tissues. No fungous decays were noted.

CORN:

Decay in green corn on the market is usually limited to bacterial soft rots following worm injury. This decay was present in several lots of Alabama and Texas stock.

CRANBERRIES:

New Jersey, Massachusetts, and Wisconsin berries showed from 1 to 4 percent fungous rots.

CUCUMBER:

Bacterial rot (Bacterium lachrymans) was prevalent in cucumbers from Cuba, Florida, Missouri, and Pennsylvania. In a few lots the decay ranged to as high as 25 percent.

Cottony leak (*Pythium* spp.) was noted in May, affecting Texas stock to the extent of 3 percent in a few lots.

Bacterial soft rot (*Bacillus* spp.) and *Rhizopus* rot are among the most common diseases of cucumber on the market, and these are generally present in stock from all regions.

Anthracnose (*Colletotrichum lagenarium*) was not of serious consequence on this market.

Such defects as shriveled ends and yellowing caused greatest depreciation in market value.

EGGPLANT:

Phomopsis fruit rot (*Phomopsis vexans*) is the only serious disease usually affecting this crop. This decay was found in various stages in stock from Florida and Cuba. In one instance decay ranged to 75 percent of the lot. The usual range of decay is around 5 to 10 percent when it is present at all in a given load.

GARLIC:

The most common decays of garlic are induced by a species of blue mold (*Penicillium*) and black mold (*Aspergillus niger*). The usual range of decay caused by these molds is about 2 percent. Frequently, in storage lots that have been allowed to become moist or heated, the decay may range from 25 to 50 percent of the lot.

GRAPES:

Blue mold rot (*Penicillium* spp.) and gray mold rot (*Botrytis* spp.) are the most common decays of grapes. In California grapes marketed during September and October many lots were found showing 2 to 10 percent decay by these diseases. California grapes in storage, marketed in January, frequently showed some damage by sodium bisulphite in the sawdust.

GRAPEFRUIT:

As a rule, grapefruit and other citrus fruit arriving on the market show little decay. Blemishes due to scarring, storage spotting, or pox are among the most serious marketing factors.

Stem-end rot due to *Diplodia* was found in high percentages in many cars of Texas grapefruit during October and November. For example, one car showed a range in decay of from 5 percent in some boxes to 50 percent in others, average for the load, 22 percent. In November and December several cars showed some anthracnose stem-end rot (*Colletotrichum gloeosporioides*).

Stem-end rot (Diplodia and Phomopsis) in Florida stock, when found, generally showed not more than 3 or 4 percent.

Blue mold rot (Penicillium spp.) was present, as usual, in small amounts in stock from all regions.

HONEYDEW AND HONEYBALL MELONS:

Rhizopus and Fusarium rots were the most common transit decays noted in this group of melons. These diseases occurred in some cars to the extent of 12 percent, but generally this type of decay ranged from 1 to 3 percent in most cars. One or two lots of California honeydews showed an unusual water-soaked type of decay from which Rhizoctonia bataticola was isolated. This is the first isolation of this fungus from melons that the writer has made.

LETTUCE:

Bacterial soft rot (Bacterium spp.) was by far the most common decay in lettuce from all regions. Although this disease was present in many cars, it rarely affected more than 5 percent, and in most cases it was confined to one or two outer leaves that are usually trimmed off. In some instances of evident mishandling or of poor refrigeration this decay was found affecting as much as 32 percent of the stock. Rather high percentages of bacterial soft rot were especially common in cars of lettuce showing tip-burn.

Tip-burn causes more serious loss and affects the marketability of affected stock more than any other single factor. This non-parasitic trouble often affects 50 percent or more of the lettuce from some regions during certain seasons.

Watery soft rot (Sclerotinia sclerotiorum) was of little commercial significance except in a few cars of Arizona lettuce.

Gray mold rot (Botrytis spp.) and downy mildew (Bremia lactucae) were not found causing appreciable damage this year.

Brown blight was found only in a few cars from California and Arizona. The resistant varieties of lettuce now being grown have apparently effectively controlled this disease as a market factor.

LEMON:

Blue mold and green mold (Penicillium spp.) were the only parasitic diseases found, and these were seldom present in more than 1 to 3 percent of the lemons in most lots. Occasionally a car showed a range of decay of

2 to 14 percent in various boxes, the average for one particular car being 6 percent. Physiological troubles such as "internal decline" (endoxerosis), pitting, and oil spotting generally caused more market loss than any parasitic disease.

ONION:

As in years past, bacterial soft rot (Bacterium spp.) and gray mold rot (Botrytis spp.) caused more damage to onions than any other diseases. Bacterial soft rot was unusually serious in Texas onions during May. In some instances the decay ranged to as high as 85 percent. The average decay in several cars was above 25 percent. Damp and poorly cured stock that becomes warm in transit is especially susceptible to bacterial soft rot. A Fusarium and an associated Macrosporium rot was also present in some of the Texas stock.

Gray mold rot affected appreciable percentages of onions from Michigan, Colorado, Texas, Utah, Washington, Oregon, Mississippi, and California. When present, in most instances, the range in decay was from 3 to 15 percent, averaging about 5 percent in most cars, with an exceptional lot now and then showing as high as 50 percent gray mold rot. This is the most serious storage disease throughout the year.

Next to gray mold rot, the physiological deterioration usually referred to as storage breakdown was the most serious storage trouble of onions. Unfortunately, this breakdown has many characteristics of freezing injury and it is not possible, in many instances, to distinguish between these troubles. The watery, translucent, fleshy scales frequently offer easy access to such decay-producing organisms as bacteria and Botrytis. This type of breakdown was serious in much of the Michigan and Colorado onions marketed during January and February.

ORANGE:

Most decay of any consequence in oranges received on the market was due to blue mold (Penicillium spp.). This decay was prevalent to some extent in stock from all regions, but the decay generally ranged below 5 percent. In one car blue mold rot affected 2 to 22 percent of the fruits in various boxes, the average for the load being 12 percent. This was the most serious decay of this type noted during the year. Other serious market factors were skin discoloration, scarring, and brown spotting of fruits in storage.

Gray mold (Botrytis spp.) was found in a few cars of California oranges, and in April anthracnose stem-end rot (Colletotrichum gloeosporioides) was also noted in a few lots.

PEA:

Most of the peas received on the Chicago market originate in California, Washington, Oregon, Mississippi, and Mexico. Defects consisting of scars, over-mature and poorly-filled pods were generally the most serious marketing factors. These defects ran unusually high in most cars, often reaching 40 percent, the average range being about 10 to 20 percent.

Pod-spot (Ascochyta pisi) caused relatively little damage, although it was noted in California and Oregon stock, sometimes ranging to 5 percent. Usually there are no secondary decays following this spot, so, for practical purposes, it should probably be classed as a blemish.

A slight amount of watery soft rot (Sclerotinia sclerotiorum) was found in California peas.

Gray mold rot (Botrytis spp.) was found affecting 5 to 10 percent of the peas in a few cars received from Washington.

Mosaic is becoming an important market factor in California and Oregon peas. Many cars of peas showed 5 to 25 percent of the stock conspicuously malformed.

California peas received during September and October often had severe blemishes by the Cladosporium scab. One car showed 75 percent of the stock noticeably blemished by this trouble. Lots showing 10 to 25 percent of this scab were common. Fortunately, no decay follows or is associated with this disease.

During November a few cars of California peas showed a physiological spotting of the seed-coat. The pods appeared normal in every respect, but many of the seeds within showed yellowish-brown discolored areas on the seed coat next to the pod wall. A number of isolations from such discolored tissue showed it to be sterile.

A few lots of Mississippi peas showed an appreciable percentage affected by bacterial spot (Bacterium pisi).

PEACHES:

The most serious decays of peaches were caused by brown rot (Sclerotinia fructicola) and Rhizopus rot, regardless of the point of origin of the stock. Frequently these two diseases were associated in the same car, rhizopus being especially prevalent in the warmer top layers. Brown rot was also serious in the top layers of baskets, but it was not inhibited quite so much by the lower temperatures in the bottom layers as was Rhizopus rot. The difference in temperature between the fruit at the bottom and the top of the load usually ranged from 5 degrees to 7 degrees Fahrenheit. The usual range at the bottom was 43 to 46 degrees, at the top 48 to 50 degrees.

The most serious decay was found in a car of Georgia peaches received the last of July. This car showed 15 to 70 percent decay, with an average of 40 percent, practically all of which was brown rot. The fruit in the bottom layer baskets had a temperature of 40 degrees Fahrenheit and had 15 percent decay. The top layer baskets showed a fruit temperature of 49 degrees Fahrenheit and showed brown rot affecting 70 percent of the fruit.

PEARS:

The pears received on this market were generally in good condition as far as decay was concerned. One or 2 percent of blue mold (Penicillium spp.) was occasionally found and a slight amount of Alternaria rot was noted in a few lots. A car of Washington Anjou pears received in March showed about the highest decay noted. Many boxes in this car showed around 8 percent of blue mold and occasionally a fruit or two affected with gray mold.

Although brown rot (Sclerotinia cinerea) was not common, it was found affecting 35 to 50 percent of the pears in some boxes received from Washington in April.

Storage breakdown of Bartlett pears was severe in many lots held in cold storage.

Illinois Kieffer pears held in storage suffered much loss on account of a breakdown about the core. The external appearance of this stock was good.

PEPPERS:

As a rule, Rhizopus rot takes a rather high toll of peppers on the market. The decay caused by this organism usually averages about 5 percent.

Florida peppers received during April and May were often seriously affected by Phytophthora rot. Several cars showed a range of 5 to 45 percent, with an average of 20 percent decay. Bacterial soft rot followed in much of this diseased stock.

Bacterial spot (Bacterium vesicatorium) and gray mold rot (Botrytis spp.) were of slight consequence this year, although gray mold occurred in a few lots of storage peppers. California peppers in cold storage frequently showed heavy losses on account of decay caused by Cladosporium and Botrytis. Some stock showed as much as 25 percent of decay in advanced stages.

Charcoal rot (Rhizoctonia bataticola) was found affecting a few peppers received in July from New Jersey.

PINEAPPLES:

Pineapples received in June from Mexico sometimes showed as high as 60 percent decay induced by bacteria, yeasts, and the various secondary fungi, following bruises and mechanical injury in fully ripe stock.

Bacteria and Rhizopus caused serious loss in several lots of Cuban pineapples received in June. One car arrived showing 75 percent of the fruits affected with Rhizopus and bacteria.

PLUMS AND PRUNES:

These products usually suffer very little decay during transit. Only a few lots were noted that showed any appreciable decay, the causal organism being, in most cases, either Rhizopus or Penicillium.

POTATOES:

Fusarium tuber rot (Fusarium spp.) caused more loss in potatoes from the important shipping sections than any other decay. Potatoes from Idaho, Michigan, Wisconsin, Minnesota, Colorado, and North Dakota showed this decay, generally ranging from 1 to 10 percent in many cars.

Jelly-end rot (mostly Fusarium) was noted causing about 5 percent decay in a few cars of Colorado and Idaho potatoes.

Hollow-heart occurred in excessive amounts in potatoes from Michigan, Minnesota, and Wisconsin. Many cars showed 5 to 15 percent, and occasional cars showed as much as 50 percent of the potatoes with hollow-heart. Other defects incident to tuber development, such as secondary growth knobs and growth cracks, also lowered the market value of this stock.

Scab (Actinomyces scabies) was of little consequence except in a few lots of Wisconsin, Michigan, and New Jersey potatoes.

Bacterial soft rot (Bacterium spp.) continues to be the most serious decay in southern grown potatoes. Mechanical injury incident to harvesting, grading, and packing this immature stock opens the way for bacterial infection, and the warm temperature favors development of the organisms during transit and marketing. This decay is especially serious in potatoes that show sun scald.

The increasing practice of washing southern-grown potatoes has also led to serious consequences in some regions. In many lots of potatoes not properly dried before loading, the surface moisture has greatly favored the development of bacterial soft rot during transit. Washing vats that are not kept clean or not renewed with fresh water often may lead to contamination of potatoes. The development of some sterilizing wash, such as formaldehyde or borax, along with better methods of rinsing and drying the tubers before packing is highly desirable.

Tubers grown in moist soil and having enlarged lenticels frequently become infected with bacterial soft rot when loaded wet or moist.

The range of decay by bacterial soft rot varies considerably, often not reaching over 10 or 15 percent, but some lots came to attention from Florida, Alabama, and Louisiana that showed sun scald and decay ranging to 40 percent of the load.

Practically all bacterial soft rot found in northern grown potatoes follows freezing injury.

Sclerotium rot (*Sclerotium rolfsii*) was found in a few cars of Alabama potatoes, sometimes to the extent of 10 percent.

Late blight (*Phytophthora infestans*) and *Alternaria* tuber rots (*Alternaria solani*) were not of serious consequence on this market except in a few lots of Wisconsin potatoes.

Insect injuries caused relatively little trouble. A few cars of New Jersey potatoes showed wire-worm injury and a small percentage of Virginia potatoes showed tuber moth injury.

RADISHES:

The only decay of importance in radishes on the market is bacterial soft rot affecting the tops. Generally this decay is not serious, but occasionally in excessively injured or bruised tops and where high temperatures prevail the decay does become important. Some Texas and California radishes on inspection showed from 15 percent to as high as 75 percent of the leaves diseased. Although the roots are remarkably free from decay, the market value of the bunch radish is greatly influenced by the tops.

A few lots of Ohio radishes showed a small percentage of root rot induced by a species of *Fusarium*.

RHUBARB:

Gray mold rot (*Botrytis* spp.) was the only decay found in rhubarb. This trouble frequently affects 5 to 10 percent of Oregon rhubarb received on this market. Some lots showing a low percentage of decay on arrival, showed as high as 30 to 50 percent after having been held in storage for three weeks. Practically all of this infection is located at the base of the stalks.

RUTABAGAS AND TURNIPS:

The only decay of any consequence in these crops was noted in rutabagas from Canada. A few lots of this stock showed gray mold rot (*Botrytis* spp.) and fusarium rot (*Fusarium* spp.) to the extent of 3 to 5 percent.

SPINACH:

The spinach received on the Chicago market originated in Texas, California, Colorado, and Arkansas. In stock from these States bacterial soft rot was the most important disease. In most instances the decay ranged from 1 to 5 percent, but a few cars showed as high as 17 percent. Practically all bacterial soft rot originated in crushed and broken stems and leaves, or followed in yellow or brown leaf margins injured by freezing, wind-whipping or other unfavorable growing conditions.

Although downy mildew (*Peronospora effusa*) was present in many cars it was generally of little consequence. The yellow spots were usually inconspicuous and affected the marketability of the stock very little.

Brown and yellow discolorations, due to age and various types of injuries, were among the most important market factors.

SQUASH:

The squash received on the market is usually free from decay. The stock held in cold storage, however, sometimes shows losses on account of decay induced by species of *Alternaria*, *Cladosporium*, *Fusarium*, and *Botrytis*. The most serious loss noted was in a lot of Minnesota squash which showed 37 percent decay induced by *Botrytis*.

STRAWBERRIES:

There is always a great deal of variation in the decay in strawberries shipped from the various producing centers. *Rhizopus* soft rot generally causes as much as or more serious decay than the other diseases because it is ever-present in over-ripe berries and in berries showing excessive mechanical injury, and in stock that has not been properly refrigerated.

Gray mold rot (Botrytis spp.) probably ranked second as a cause of decay but this was not often serious. A few lots of berries received from Idaho and Michigan showed 5 to 15 percent decay by gray mold rot.

Leather rot (Phytophthora spp.) was found affecting berries from Tennessee and Kentucky, the usual range of decay being between 2 and 15 percent. Sclerotinia rot was also found in small amounts in Kentucky strawberries.

SWEET POTATOES:

Rhizopus soft rot was the principal decay noted in shipments from all districts. Generally this decay, when present, affected less than 5 percent of the stock, but occasionally it ranged to 25 percent. Java black rot (Diplodia tubericola) and foot rot (Plenodomus destruens) were found causing a small amount of decay in several lots of sweet potatoes from Louisiana.

Blue mold rot (Penicillium spp.) also caused serious decay in storage lots of Porto Rican yams from Louisiana that were marketed in July.

Growth cracks, cuts, rodent injury and weevil injury were common defects in the Kentucky and Tennessee stock. These defects sometimes ranged to as high as 40 percent in some lots.

TOMATOES:

Among the pathogens common to all the tomato producing regions species of Alternaria and bacteria took the highest toll throughout the year. Alternaria rot and bacterial soft rot affected 10 to 28 percent of the tomatoes in several cars of Florida stock received during January. Alternaria rot alone was found affecting from 2 to 5 percent of the tomatoes received from Cuba, Mexico, and California. Most Alternaria rot in California tomatoes occurs in the late fall and early winter crop. In some cars the stem-end decay induced by Alternaria becomes quite serious during the transit period, and causes extremely heavy losses in stock that is held on track or in ripening rooms. It is not uncommon to find tomatoes showing only 5 to 10 percent Alternaria rot on arrival show as much as 50 percent decay after being held a week for ripening.

Pleospora rot (Pleospora lycopersici) was found occasionally in a few lots of California tomatoes received during November.

Anthracnose (Colletotrichum phomoides) was found in a few tomatoes received from Cuba but it was not of serious commercial importance.

*Rhizopus* rot was found causing 1 to 5 percent decay in many cars of tomatoes, but, generally speaking, it was not severe except in cars showing one-half or more of the tomatoes ripe on arrival. *Rhizopus* rot is also frequently a cause of serious decay in tomatoes held for ripening. The warm temperature and high humidity maintained in the ripening rooms favor its rapid development. This decay is often associated with bacterial soft rot in ripe, bruised, or roughly handled stock in cars that have been allowed to become overly warm.

*Phoma* rot (*Phoma destructiva*) caused heavy losses in many cars of Florida tomatoes shipped during April and May. A number of cars showed a range of 3 to 20 percent, with an average of about 8 percent *Phoma* rot on arrival. Stock showing only small percentages on arrival sometimes showed as high as 60 percent affected tomatoes after being held in ripening rooms for a few days. Along with the usual stem-end infection, there was an unusual amount of infection through small wounds and scars over the shoulders and sides of the fruit. *Phoma* rot also caused a slight amount of damage to Mississippi tomatoes shipped in June.

Late blight tomato rot (*Phytophthora infestans*) was a marketing factor in the October and November California crop of tomatoes. Many cars showed around 5 percent late blight rot on arrival. The most serious decay noted was in a car inspected the last of October, which showed a range of decay from 3 to 50 percent, the average for the load being 20 percent.

The varieties of tomatoes now grown in most commercial regions are apparently very resistant to nail-head spot (*Alternaria tomato*). Only a few tomatoes grown in Missouri were found to show this blemish.

One lot of Texas tomatoes was found showing sulphur-dioxide injury. These fruits were injured by the burning of sulphur in the storage room in an attempt to control development of decay.

WATERMELON:

Friction bruises and scarring due to contact with floors and side walls in cars with improper bedding cause more damage to watermelons in transit than any other factor. In many instances, the wounds offer entrance to bacteria of the soft rot type. Some cars noted showed as high as 10 percent bacterial soft rot following bruises. One car of Georgia melons showed from 25 to 40 percent decaying with bacterial soft rot following in contact bruises.

Only a few cars of Florida and Georgia melons showed any appreciable stem-end rot (*Diplodia tubericola*) and in most lots anthracnose (*Colletotrichum lagenarium*) was of no consequence.

# SOME ASPECTS OF THE PLANT DISEASE ERADICATION AND CONTROL WORK OF THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Papers by members of the Bureau of Entomology and Plant Quarantine.

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Contents

## THE DUTCH ELM DISEASE ERADICATION PROGRAM— OBJECTIVE, METHODS, AND RESULTS

By O. N. Liming, Agent in charge of Dutch elm disease eradication field work, Division of Japanese Beetle Control, Bureau of Entomology and Plant Quarantine.

### Statement of Principles

The immediate control and ultimate eradication of the disease from the United States is the objective of the Dutch elm disease program. In the major area around New York City, where the disease has reached an epidemic form, control is a necessary prerequisite to ultimate eradication. In areas where the disease is largely limited to primary infections eradication methods are immediately applicable.

Definite checking of the spread of the disease within and from the infected area and a reduction in the amount of the disease may constitute control. This condition may be secured by a general and large-scale field operation over the entire area, provided the efforts are timely and uninterrupted. Following control, eradication may require specialized treatment of a number of small disease centers within the original large area. The justification for this objective, the methods of control and eradication, and the evaluation of the results are based upon the nature of the disease and its insect carriers. Data on these subjects have been secured by fundamental research in combination with field tests and observations.

### The Disease and Insect Vectors

Many reports on the status of the Dutch elm disease in Europe indicate that the epidemic has spread over all but the northern countries and that it has continued its ravages throughout the disease area. Field observations and research tests, made in Europe, early showed that the American elm, *Ulmus americana*, is one of the most susceptible elm species. The *Scolytus* bark beetles are recognized as the principal vectors of the disease. Various attempts to prevent infection and to cure diseased trees have been made but no successful treatment has been found. On these bases the eradication of the disease as the only assurance of saving the elms in America was early decided upon.

In America the Dutch elm disease epidemic is limited to a small area centering on New York City, extending about 50 miles radially, and comprising about 4,800 square miles, where about 22,000 diseased trees have been found. The intensity of the disease has reached as high as 100 trees per square mile or 10 percent of the elms in certain small centers within the major disease area. However, near the 50-mile limits the known disease locations may be 5 to 10 miles apart and contain only 1 to 5 trees at each point.

Diseased and *Scolytus*-infested elm burl logs from Europe entered this country as early as 1925 and continued to enter until 1934. During this period 11 shipments entered at New York City, 22 at Baltimore, 9 at Norfolk, and 16 at New Orleans. In general these logs were loaded on freight cars and shipped to veneer factories in the Central or Midwest States. Seven small disease centers in addition to the major New Jersey-New York area are traceable to these logs. There is now an embargo against elm material.

The Dutch elm disease is a systemic disease characterized by the formation of gums and tyloses in the water vessels of the current year's wood. The fungus, *Ceratostomella ulmi*, once gaining entrance to the active vascular system, may spread rapidly in the water stream upward and by gravity downward. Although of limited growth as a parasite, it maintains itself and sporulates abundantly on dead wood and bark. The limited growth and apparent lack of surface fruiting on living material is a distinct advantage to the eradication program. Except when introduced into wood already dead, conspicuous disease symptoms develop before a dangerous supply of inoculum is produced.

Insects that penetrate to the living wood of elms may be considered important vectors of the Dutch elm disease. The bark beetles that, upon emerging from fungus-bearing material, attack through the bark are consequently the most successful vectors. *Scolytus multistriatus*, the small European elm bark beetle, and *Hylurgopinus rufipes*, the American elm bark beetle, are considered the two important disease vectors in America. The *Scolytus* beetle has become established in three areas in the United States. The Boston infestation probably originated several years before it was reported in 1909. The New Jersey-New York infestation was not reported until 1924, but field conditions indicate that this infestation is as old as the Boston center. The third center, in the upper Ohio River Valley, apparently started from elm burl logs sometime after 1925.

Only in the New Jersey-New York area have the Dutch elm disease and this insect become definitely associated. Nevertheless, the presence of this important vector in two other important elm areas, New England and Central States, adds materially to the need for immediate action. *H. rufipes*, with habits somewhat similar to those of *Scolytus*, is distributed throughout the entire elm area in America. Not only is *Hylurgopinus* an important vector but it may serve as a bridge for the disease, between the major disease area and the other two *Scolytus* areas. In contrast to the absence of *Scolytus*, *Hylurgopinus* has been found in all of the outside disease areas.

## Location and Removal of Diseased Trees

The timely location and prompt removal of all Dutch elm disease trees is a necessary step toward control and eradication. In general, this project consists of three essential parts; (1) locating and sampling of wilted and dying elms, (2) mapping of elm-free areas and scattered elms, and (3) locating and tagging of devitalized elms. This survey at the present time includes (1) about 4,800 square miles of disease area all within 50 miles of New York City, (2) about 2,700 square miles in a protective zone around this area, (3) sixteen outside areas, principally port cities and Midwest cities that handled imported logs, and (4) about 12,000 miles of railroad that hauled these logs.

The nature of the disease, especially the development of external symptoms early in the course of the disease, makes the systematic examination of all elms an effective means of locating a large percentage of the trees. Evident wilting and dying of a branch or an entire tree may occur any time after the last of May and until the first of September. As these external symptoms of the Dutch elm disease are more acute in the early summer, the most effective scouting can be done in June and July. Those trees in which the disease appears in a chronic form and those in which the Dutch elm disease symptoms are masked by the effects of drought, other diseases, insect attack, or unfavorable soil conditions, create special scouting problems. One of the most effective means of eliminating these chronic and masked trees is the systematic removal of all dead and devitalized elms. As these trees can be more effectively detected during the foliar season, the locating and tagging of such trees forms a part of the scouting work in August and September.

In rough undeveloped areas where the scattered wild elms have been removed, the remaining elms along roads and around farm homes may be reached by a combination of foot and auto scouting. In developed rural sections and urban areas scouting must be done entirely on foot. The autogiro has been found effective in locating diseased elms in undeveloped areas.

The effectiveness of the scouting work is dependent largely upon the location and removal of diseased trees before elm bark beetles emerge from them. From the time of first wilting and concurrent beetle attack there is, in general, a 40-day period before beetle emergence begins. Providing the tree is located promptly, and allowing 7 days for laboratory diagnosis, 10 days for obtaining clearance from property owner, and then two weeks for final removal, the entire operation may be completed 10 days before the time when beetles would emerge. In general, during this maximum period of 30 days, from the time of first wilting until removal, the tree has not become a menace as a source of disease spread. This delay in becoming a menace adds materially to the effectiveness and probable success of the eradication program.

The degree of thoroughness and timeliness with which the scouting program can be completed is influenced by (1) the number and quality of scouts employed, (2) the time of the year when their services are available, (3) the equipment necessary for efficient work, and (4) the degree of cooperation of the States in which the work is done. The extra work of removing the large number of diseased trees that had accumulated before the work began, the task of locating or creating and mapping elm-free and scattered elm areas and the job of developing trained scouts and scouting equipment have added to the cost of the program during the first few years.

Owing to the type of scouts employed, the amount and quality of work have not been up to the standards set for the program. Another unfortunate circumstance has been the seemingly recurrent impossibility of having a full force at work in June and July, the critical period of the summer work. In general, the removal of diseased trees within the time limits described has been successfully completed in both 1935 and 1936. The tools required for scouting and tree removal have at certain periods been somewhat limited.

The results of the scouting program may be determined by comparing the field conditions in 1933 with those observed in 1936. In 1933 and 1934, scouting was concentrated in the urban areas within the heavily infected zone and these areas again received good attention in 1935 and 1936. In contrast to 1933 and 1934, most of the diseased trees were located and removed in 1935 and 1936 before a brood of disease-carrying beetles had emerged. Based on the number of diseased trees found and the general field observations, there has been a striking decrease in the intensity of the disease and local spread has been definitely checked in these urban areas.

Only during the last two years, and principally in 1936, have the undeveloped portions of the disease area and the protective zone been scouted with any degree of thoroughness. Consequently, a satisfactory reduction has not been made and the work has only been able to hold the disease in check in the undeveloped areas. At the outer limits of the disease area and in the protective zone, some additional diseased trees were found in 1936. Examination of these trees showed, however, that they were not current infections in most instances but largely older infections not found until 1936. In this area in general there was no recurrence of the disease in areas where it had been found in 1934 or in 1935. Furthermore, with but one exception, the new locations are within the 50-mile limits of the disease. Apparently the work in the heavily diseased area has effectively reduced or stopped the spread of the disease into these outer areas.

In the disease centers outside the major disease area, scouting did not uncover a single tree that had become diseased in 1936. With but one exception, those trees that were found showed evidence of having been infected from the original source of inoculum from imported logs. In Indianapolis a disease center containing 11 diseased trees which apparently resulted from secondary spread in 1934 and 1935 was not found until 1936. There was no recurrence of the disease found at Cincinnati, Cleveland, and Brunswick, Maryland. There was found one diseased tree at Baltimore, one at Cumberland, Maryland, and one at Norfolk, Virginia, all three trees being of older infection and none having produced disease-carrying beetles. Thorough scouting and special sanitation work have resulted in the apparent eradication of the Dutch elm disease at Old Lyme, Connecticut. In general, eradication has been effected or is unquestionably within reach in these outside areas. The scouting of the 12,000 miles of railroads that carried imported logs has not been satisfactorily completed. The negative results of the preliminary survey that has been made are considered satisfactory evidence that no serious disease center has escaped detection.

## Sanitation and Silvicide Work

Field observations supplemented by laboratory tests indicate that dead and dying or devitalized elms may harbor *Ceratostomella ulmi* either as a saprophyte in the dead wood or as a parasite producing a chronic disease form. In certain areas of the heavily infected zone from 3 to 30 percent of this class of trees produced *C. ulmi* in culture. As a step toward eradication these trees, as a class, have been condemned and removed. In addition to these devitalized elms there are a large number of wild and worthless elms in many of the wooded and swampy areas. Owing to disturbance resulting from varied land uses in the large metropolitan area, many of these elms are in a declining condition. In the mountainous areas, where the elms are of very minor importance, by removing from 5 to 10 percent of the total elms and leaving only the valuable shade and roadside elms, a large portion of the area may be made elm free. Inasmuch as a large part of the protective zone is made up of this type of terrain, the elm-free areas may tend to serve as a barrier to the disease.

The removal of devitalized elms was started during the 1933-34 winter and was emphasized during the last two winters. At the end of the present work period about one and three-quarter million elms have been removed. Another three-quarter million are scheduled for removal during the remainder of the winter season. When these are disposed of, practically all elms more than 50 percent dead will have been removed from the entire major disease area. In addition to these elms about half a million elms have been removed from swamp areas in clear-cutting operations in New Jersey. The attack on the worthless woodland elms only began in the fall of 1936. A rapid method of killing these trees and rendering them harmless by a chemical treatment has made it possible to handle about half a million woodland trees, principally in New Jersey, during the last three months.

In contrast to the extreme difficulties encountered in securing and training an adequate scouting force, personnel problems on the sanitation project have not been so troublesome. A large percentage of the field force consists of laborers; and those in relief, except in strictly city areas, are able to do an acceptable job. Furthermore, the supervisors and higher grade scouts used during the summer work are able to do the skilled work and to supervise the labor crews. One disconcerting feature, however, has been the inability to keep the project going without interruptions and temporary lay-offs during the winter. During the last two winters a field force of 3,000 to 5,000 has been employed in sanitation work. In addition to this force, men from six CCC camps have been employed satisfactorily on this sanitation project the last 2 years.

The equipment problem has caused some inefficiency in the work, but at the present time the field force is reasonably well equipped. Because of the low quality of some of the tools, especially axes and saws, large replacements will be required before the work is completed. Although many new cars and trucks have been purchased during the last two years, it still is necessary to use many obsolete pieces and to hire, at high rental, additional trucks. When this condition is corrected, the efficiency of the sanitation crews as well as the summer scouts will be materially advanced. The use of power equipment, caterpillar tractors, and pneumatic driven chain saws has increased the production of the crews so equipped.

The chemical treatment of trees, popularly called silvicide, has been emphasized this winter. It consists of removing the bark around the trunk about breast high and applying a band of copper sulphate. The chemical is held in place by a band of oil cloth securely nailed on and sealed to prevent washing by rain water running down the trunk. The copper sulphate, comparable to granulated sugar in fineness, is used in the dry form. The moisture in the wood during the winter season is sufficient to bring the copper slowly into solution. Field observations indicate that the copper readily moves down through the trunk and into the roots. Previous experience with stumps shows that the root system may be killed in this manner. During the winter season the upward movement is somewhat limited, but during the foliar season the copper may move rapidly upward to the small twigs. Inasmuch as the chemical is concentrated in the outer annual ring and cambial region it may act as an insecticide or repellent to the bark beetles.

Confirmed Dutch elm disease trees and those with appreciable amounts of dead or beetle-infested wood are not so treated, but are promptly disposed of by cutting and burning. The large project of treating or removing scattered elms from mountainous areas, particularly in the protective zone, has not been started. It is proposed to carry on this work during the summer season in connection with scouting.

It must be noted that only devitalized or diseased and worthless wild elms are involved in the sanitation project. Excepting those valuable elms that have been or may in the future be destroyed because of actual attack by the Dutch elm disease, no valuable elms are condemned. Analysis of the field reports in 1934-35 indicate that about 80 percent of the elms removed were less than 4 inches in diameter. The removal of large dead and dying elms, especially lawn and street trees, is a definite asset to the property owner. The low vitality of many elms in certain swamp and artificial water supply areas is considered evidence that under these conditions elms are not a desirable species, and so their removal or treatment may be considered a good forestry practice.

## Discussion

In conclusion, certain general summary statements of the accomplishments to date and limited estimates of the future of the project may be made. At the start of the major eradication program in 1933 the question "Can the Dutch elm disease be eradicated in the United States?" could not be answered. It was believed that a delay of field operations, while awaiting the answer, would be not only undesirable but fatal to the elms. It was believed then that the results of one year's work in which the field operations were timely and thorough, would provide the answer. Unfortunately, it has been impossible to reach this standard of operation during any one year since 1933 to the present time. However, the accumulative effects of several years of work in the entire disease area and the local effects of the work in certain small areas where the operations have been timely and complete in 1935 and 1936 may be significant. It is thus possible at this time to present data that will probably answer the question "Can the Dutch elm disease be eradicated?"

As previously indicated, control of the disease must prevent spread within and from the area and must reduce the number of diseased trees until the major disease area consists only of several small separate centers. This condition has been attained in several parts of the major disease areas that have received adequate attention. The number of diseased trees found in certain areas in 1934, 1935, and 1936, respectively, may illustrate this point.

| | 1934 | 1935 | 1936 |
|---|---|---|---|
| Staten Island, N. Y. | 671 | 327 | 69 |
| Queens County, N. Y. | 54 | 16 | 6 |
| Mamaroneck, N. Y. | 110 | 54 | 25 |
| Mt. Vernon, N. Y. | 78 | 32 | 15 |
| Irvington, N. J. | 57 | 14 | 3 |
| Orange, N. J. | 98 | 13 | 4 |
| Roselle, N. J. | 14 | 5 | 1 |
| Hillside, N. J. | 33 | 16 | 4 |

In areas where spread has been stopped and the backlog of disease has been materially reduced the situation is comparable to that in areas where the number of diseased trees is small and spread has never occurred. Thus the remaining centers within the former major disease area may be eradicated by the same methods found successful in the small outside centers where eradication has been effected or is at hand. There may be mentioned specifically, Cincinnati where the first tree was found in 1930, Old Lyme, Connecticut, where a definite threat to New England existed in 1934, and Cleveland, Ohio, where no disease was found in 1936. In fact, satisfactory results toward eradication have been realized in all outside areas, except at Indianapolis, where the program was not thorough in 1935.

Therefore, the question of eradication may be answered affirmatively on the basis of actual control in heavily diseased areas at the present time and satisfactory evidence of eradication in the smaller disease centers. Believing that the disease can be eradicated, the reaching of this objective then depends on the uninterrupted attack, by methods that have proven satisfactory, through years immediately ahead on an adequate and timely basis.

## WHITE PINE BLISTER RUST CONTROL AND BARBERRY ERADICATION IN 1936

By S. B. Fracker, Principal Plant Quarantine Administrator, Division of Plant Disease Control, Bureau of Entomology and Plant Quarantine.

### PROGRESS IN BLISTER RUST CONTROL

There are in the United States about 15,000,000 acres of forest land on which five-leafed pines of commercial value and quality are now growing. If this entire 15,000,000 acres is to be protected from blister rust infection, it will be necessary to remove the currant and gooseberry plants not only from among the trees but also for a distance of some 900 feet from the stands. These surrounding protective zones increase the acreage to be covered to about 26,000,000 acres of land. The status of the program at the present time is that over two-thirds of these 26,000,000 acres, approximately 18,000,000 acres, have been covered and the Ribes removed at least once.

During the past summer, as a measure of unemployment relief, Ribes-eradication crews totalling about 14,000 men have been maintained in the field in 29 States. These crews have removed the Ribes from 3,829,890 acres, covering the ground at the rate of approximately 3.6 acres per man-day. In this work about 196,211,187 Ribes have been destroyed during the past summer. In terms of pine this presumably represents the protection of between 100,000,000 and 200,000,000 pine trees this season.

It was about 1918 when the foresters and forest pathologists of the country faced the fact that white pine blister rust (Cronartium ribicola) was established in the United States beyond the possibility of total eradication and could only be prevented from destroying one of America's most valuable forest trees by covering the woods foot by foot and acre by acre to eliminate the currant and gooseberry plants. It is probable that the most common mental reservation as to the practicability of such an undertaking related to the extensive areas and tremendous numbers of plants involved. This sometimes found expression with respect to the Rocky Mountain regions in the thought that covering these vast, apparently trackless areas and attempting to destroy wild Ribes throughout them seemed to be an inconceivably hopeless undertaking. One has only to climb one of the fire towers in the vicinity of the Bitterroot Mountains or in the Sierra Nevadas and survey from there the stands of Western white pine or of sugar pine to be impressed with that point of view.

Fortunately, however, it was not necessary to undertake white pine blister rust control with the expectation that the whole job would have to be completed, that is that 100 percent of the pine stands should be covered or the work would be valueless. On the other hand, in the case of this project each separate stand, or square mile, or township, or county, of white pine is a separate project of its own. The elimination of the Ribes in and around such a stand or area and the maintenance of Ribes-free conditions there means the protection of that tract regardless of what may happen to the surrounding stands or to the rest of the country as a whole. As soon as the foresters convinced themselves that Ribes eradication could be carried out at a cost which the value of the trees would later repay, and that such costs were only a small proportion of the expense of letting the forest go down with disease and then replanting with some other species, a foundation was laid for undertaking to protect as large a proportion of the country's pine stands as possible.

In the industrial and commercial development of the United States, labor has always been the scarcest and most costly factor in production. Ribes eradication in the pine forests could not be carried out without the use of large numbers of laborers because there is no way of developing machines which will distinguish Ribes from other plants and remove them alone. The unemployment problem developing since 1930 has resulted in making much more labor available for conservation and other public purposes. In 1933 this situation was officially recognized by the Federal Government, and the resources of the United States were thrown into the attempt to find ways of employing the available labor along lines that would give results of benefit to the public as a whole. We find, accordingly, that under these emergency employment relief programs it has been possible to employ, on white pine blister rust control, men whose labor has now totaled 3,228,342 man-days since 1933, and their work has resulted in the eradication of Ribes and of the protection of pine on 10,571,775 acres of land.

The Public Works Administration allotment to Blister Rust Control for 1933 to 1935 totaled $2,032,030, and the allotments from the Emergency Relief Appropriation Acts of 1935 and 1936 have amounted to $6,907,804 for this purpose to date.

You will be interested in learning that relief laborers have proved surprisingly effective for employment even on such work as cultivated black currant eradication and pre-eradication surveys. It was at first believed that it would be necessary to use the college-trained type of employee for work of this kind which, in the case of black currant eradication, involves interviews with house-wives and property owners and, in the case of pre-eradication surveys, ability to determine and locate the boundaries of white pine stands and to map the stands and the 900-foot borders by the use of compass and pacing. It may be that under ordinary employment conditions the ranks of the unemployed would not include men who could be trained to carry out activities of these types, but, during the past two years at least, it has been possible to choose from among the men assigned to us those who had sufficient ability, initiative, and personality to carry out work of this type satisfactorily. They need, of course, adequate and carefully trained supervisors who keep in touch with them at all times, but with such trained supervision they are accomplishing excellent results. Much of the special work of this kind, particularly of the pre-eradication survey type, is being carried on throughout the winter, although Ribes eradication in the forests cannot be carried out efficiently after the leaves have dropped. Even on this kind of winter work it is being found practicable to maintain the ratio required by the Works Progress Administration, namely, nine relief laborers to each regularly appointed supervisor.

## Spread of Infection

Now, as to the status of infection at the present time. The rust has been well established for several years in New England and in the Lake States, and has been spreading steadily southward into the Southern Appalachians in the East. In this region it was found in 1935 as far south as Bath and Nelson Counties, Virginia, and infected Ribes leaves were picked up in northern Illinois and Indiana. No spread of infection has been reported this season in the Appalachian section and no rust was discovered in 1936 in Illinois and Indiana.

The North Central Region leads in the number of newly infected counties reported in 1936. Blister rust was found on white pine for the first time in 10 counties in Wisconsin: Buffalo, Eau Claire, Winnebago, Rusk, Door, Vilas, Price, Langlade, Outagamie, and Waushara; 3 counties in Michigan: Schoolcraft, Saginaw, and St. Clair; and 1 in Minnesota: Todd.

Infection was found for the first time on Ribes in Winnebago and Sauk Counties, Wisconsin; Koochiching County, Minnesota; and Knox County, Ohio. These findings materially extend the known range of infection in the Lake States.

With respect to the western white pine region in the Pacific Northwest, an area in which some 2,700,000 acres are producing pine, it was originally thought, after observing the rapidity with which infection developed in certain localities, that 1935 or 1936 would be approximately the dead-line for the protection of those stands, and that any pine stands which had not yet been reached by that time would be so heavily infected as to be beyond saving. This original estimate did not prove to be so far wrong, for the summer of 1935 ultimately proved to be the year that the upland species of Ribes first became widely and generally infected throughout the region. The results of this infection in the development of pine cankers will not be fully ascertainable for another year or so, owing to the slow incubation period in the pine trees, but by 1935 approximately half of the entire 2,700,000 acres of western white pine area of the Northwest had already been covered in initial Ribes eradication work. Another 300,000 acres have been covered in the Northwest this year, and it now seems clear that if the work can be carried forward vigorously most of the remaining 35 to 40 percent can be protected from serious damage.

Blister rust has been found this year (1936) for the first time in California. Five locations are involved in that State, all in the two northwest counties, Del Norte and Siskiyou. Three of these cases are on Ribes only, one on pine only, and one on both hosts. The high susceptibility of sugar pine (Pinus lambertiana) was determined in experimental tests in British Columbia a number of years ago, but the recent discovery of a serious infection center on this species on Panther Mountain in southwestern Oregon constituted the first illustration of what infection on this species actually does in nature. Confirming the experimental work, this area has been about as rapidly disastrous a case of blister rust infection as has been observed anywhere in the United States. The site, although in the coastal fog belt, is a typical dry sugar pine area in which the pine is associated with Ribes cruentum, a prickly gooseberry very similar to the one common in the Sierra Nevada Mountains, Ribes roezli. Judging from the available evidence, it appears that the rust has been developing on the pine in this quite remote and inaccessible locality since about 1926, and during the 10-year period practically 100 percent of the pines of the locality have become infected. Trees up to 6 or 8 inches in diameter and 50 to 70 years in age have already been killed as a result. The rust is attacking the sugar pine there in the same manner that it kills western white pine (P. monticola), that is, through the development of cankers on such a large number of lateral branches that starvation of the tree follows, and death results from that cause. This, you will remember, distinguishes the western infection from the typical situation on the eastern white pine (P. strobus), where the death of the tree usually comes much more slowly, from cankers reaching the trunks and girdling the trees.

Fortunately, it was possible to start the protection of the sugar pine region before the rust actually was discovered in California. Of the 2,004,330 acres of sugar pine in the State, some 423,131, or about 21 percent, have now been covered at least once by Ribes eradication.

One of the interesting studies of the past few months has been a joint attempt by our Bureau and the Forest Service to evaluate the potential future production of 5-leafed pines in the west. It would take too much time to go into the details here, but the conclusions may be expressed briefly. It is estimated that on the western control areas of about 5,000,000 acres the future timber maturing after the virgin stand is cut should average 822,000,000 board feet a year, having a stumpage value of $7,400,000 and an annual lumber value of $46,640,000. Over a rotation period of 120 years the lumber value of the aggregate potential crop is estimated at $5,500,000,000.

## European Black Currant Eradication

Among the phases of blister rust control carried on by the division and the cooperating States in addition to Ribes eradication within the pine forests, the most important is the eradication of the cultivated European black currant (Ribes nigrum). Several species of black currants are much more highly susceptible to blister rust than are other Ribes, and they produce such volumes of spores that they are able in appreciable and damaging numbers to reach distances of a mile or more from the Ribes. Accordingly most of the States in which white pines are commercially important have undertaken the complete extermination of these species. The only one of this group occurring in the Eastern half of the United States is the cultivated European black currant. At the present time the Lake States are most busily engaged in European black currant eradication, this work having been substantially completed in the Northeastern States and on the Pacific Coast several years ago. In the Lake States region 85,385 cultivated black currants were destroyed during 1936 on 13,374 properties.

## Cooperation

No information is available at the present time as to the possibility of further unemployment relief allotments being granted after the present emergency funds are exhausted this winter. Accordingly our cooperators in the various States have been notified that future plans are being made in the Bureau with the expectation of returning to the former basis of cooperation in use before the emergency programs started. Under this system the United States Department of Agriculture cooperated with the various States on approximately a dollar-per-dollar basis. The Federal funds were used for the maintenance of an organization for supervision, coordination, method development, educational activities, and similar matters. All the work on private property was carried out with labor supplied by the States, towns, or private owners. The exact arrangements differed in the various States, one plan, for example, being for the State to pay the wages of the individual foreman, who would then work with crew members supplied by the individual property owner. In other cases where pine land covers considerable areas involving large numbers of property owners, as in a New England town, the town itself appropriated sufficient funds to maintain protection on all the pine within the borders of the town or township.

In much of New England and a limited part of the Lake States, the blister rust problem has become a question of maintaining the gains already made, rather than the initial coverage of any great amount of remaining acreage. The experience developed on the work since 1918 still indicates that in any one stand three successive eradications at intervals of from 5 to 10 years will probably be sufficient to provide protection from the seedling stage to maturity. The time interval varies in different localities, depending upon Ribes conditions and the density of the stand; but it is clear that, in any case in which the tree canopy completely shades the forest floor after the pines are 20 to 30 years old, further Ribes eradication is not likely to be needed in the absence of some unusual disturbances of the soil conditions.

In general, the State foresters and those State officials who are responsible for pest control appear to be alive to the situation. The forests are great public assets of especial value to the localities in which they occur, and the first and most direct responsibility for their protection thus naturally rests on the localities and States concerned, and such localities should strive to assume as much of their own responsibility for forest protection as possible.

## BARBERRY ERADICATION DEVELOPMENTS

### Grain Rust Situation

In 1935 there occurred the most disastrous grain-rust outbreak that had been suffered in the United States since 1916. Prior to that time serious damage by black stem rust to wheat and other small grains had been occurring at intervals of from three to five years. With the steady reduction in the barberry population, beginning when the barberry eradication campaign was begun in 1918, these losses were steadily and consistently decreasing. Several of the intervening years were suitable for rust development, but the number of local sources of inoculum had been greatly reduced with the progress of the barberry eradication campaign, and during those years the rust spores arriving from the South reached the Northern States too late to cause extensive damage.

Meanwhile Federal publications, from the time the barberry eradication program was begun, had pointed out clearly the two sources from which northern rust outbreaks could develop; (1) the production of the aecial stage on barberries in the northern localities concerned, and (2) the spread northward from the overwintering red or uredinial stage, in Texas and Mexico. It was further pointed out that under usual conditions the rust spread from the South arrived too late to damage the crops of spring grain in the Northern States seriously.

You will remember that in the spring of 1935 stem rust had survived the winter rather extensively in certain parts of Texas, and that heavy rainfall there in May resulted in an unusually large amount of rust development on winter wheat in that section. In fact, the estimated rust loss for Texas in the spring of 1935 exceeded 1,000,000 bushels of grain. The rust then spread northward into Kansas and Nebraska, and during the latter part of June strong winds, followed by several weeks of moist, warm weather ideal for development of rust, resulted in an epidemic extending from Mexico northward to the Canadian border. Serious as these losses were, they were confined almost entirely to wheat, and 90 percent of the loss to this crop occurred in Minnesota, North Dakota, and South Dakota, the total damage for the barberry eradication area being estimated at 118,825,000 bushels.

The weather conditions were adapted to rust development throughout the entire grain-growing area from the Allegheny Mountains to the Rockies, but material loss occurred only in the region in which the unusual series of circumstances outlined developed. In the other regions which the spread from the South did not reach, the barberry population had been so greatly reduced that there was little inoculum available and losses were either negligible or very slight. The situation on oats is especially interesting. There was no epidemic on this crop, a condition which appeared to be due to the spring scarcity of the oat strains of stem rust in Texas. Undoubtedly if the 20,000,000 barberry bushes which had been eradicated had still been in existence throughout the area, the epidemic would have extended over a much greater area, and it is possible that the oat crop would have been much more severely damaged.

It is unlikely that the particular series of circumstances which resulted in the 1935 outbreak may occur again in many years. The practice of using more rust-resistant varieties of grain for seed in the States south of the spring-wheat area, and the further reduction of barberry bushes in the upper Mississippi River Valley, are both tending to diminish the possibilities of such outbreaks in the future.

It has been of considerable interest to note that the heavy losses of 1935 have tended to increase the interest in and favorable sentiment toward barberry eradication in spite of widespread general knowledge that the completion of the eradication program would not necessarily have prevented the 1935 outbreak. This can be noted in various ways, such as in increased correspondence with inquirers as to the barberry work and its importance and an increase in the ease of contact with the property owners who are found to have barberry plants which need to be destroyed. Continuing evidence of the large number of strains of rust which are produced from and in the vicinity of barberry plants, and the difficulty of developing varieties of grain which are resistant to all the various races of rust, are making it increasingly apparent that the extermination of the barberry plant and the breeding of rust-resistant varieties must go hand in hand if agriculture is to solve the grain-rust problem and thereby reach some degree of stability in the production of small grains.

## Progress in 1936

The availability of laborers in considerable numbers under the unemployment relief program has made possible a very rapid advance in the progress of the work since 1933. Areas were intensively covered which would have taken eight to eleven years to reach at the rate of progress of 1932 and previously. Such a delay, of course, would have further complicated the control problem by allowing natural spread to continue. The principal development in the original thirteen States has been the finding of numerous barberry plants in out-of-the-way locations in areas in which it had previously been thought unnecessary to make an intensive foot-by-foot survey. This has been particularly true in Michigan and Ohio. In Michigan 480 men have been employed and about 360 in Ohio during the past summer. Between January 1 and December 31, 1936, these employees located 301,234 barberries in Michigan and 234,017 in Ohio. It is clear that the work, especially in these States, is going to take longer and involve intensive surveys of greater areas than was anticipated.

This same thing is true, although to a somewhat less extent, in several adjoining States. During the same period about 300 employees in each State located 10,804 barberries in Illinois, 17,848 in Indiana, 15,993 in Iowa, 10,629 in Minnesota, and 33,968 in Wisconsin. While these figures look very small in comparison with the million or more barberries per year which were being turned up in some of these States several years ago, they still indicate that the problem is far from completion, especially since the areas covered during this past season and for several previous years will need resurveying once or twice more after the dormant seeds in the ground have had time to germinate.

In five of the barberry eradication States west of this central Mississippi Valley area the program has reached the clean-up stage. Less than 700 barberries have been found during the past calendar year in each of the States of Wyoming, South Dakota, Nebraska, and Montana. In North Dakota a somewhat greater number have been turned up, namely, 4,100.

The question of how relief labor could advantageously be employed, especially in these western areas where barberries are becoming scarce, at first was a somewhat puzzling problem. As most of you know, the emergency regulations require that 90 percent of all the persons employed under an emergency allotment must come from relief rolls. In other words, we could arrange for the appointment of only one experienced supervisor for each 9 or more relief laborers. This problem has largely been solved by two developments; first, our being able to pick out one or two reasonably satisfactory crew foremen out of every 10 relief employees certified to us by the relief agencies and, second, by the development of a modification of the former survey procedure.

Usually we try not to have more than five or six men in a truck or car in this survey work, but there are occasions in which it is necessary to use more. In any event, in areas where woodlots are scarce and the ground accordingly can be covered rapidly, the crew leader will send one man along one series of fence rows, another along another series, and possibly several into some woodlot or stream-bed in the distance, so that by the time he reaches the farmhouse he has only one or two laborers with him. The latter are assigned to make an inspection of shrubbery and woodlots surrounding the house and barns. The property owners in most cases have been previously informed of the intended survey by the supervisor, in person or by letter. Under this system it is possible to avoid the objectionable feature of men in large groups tending to duplicate each other's work, thus provoking unfavorable comment.

The emergency funds made available for expansion of the stem rust control work in 1933 may be summarized as follows:

| | |
|---|---|
| Total amount of funds received through the P.W.A. | $750,000 |
| Total funds received through the C.W.A. | 67,663 |
| Total funds allotted from the Emergency Relief Appropriation Acts of 1935 and 1936 to date | 2,775,500 |
| Grand total | $3,593,163 |

While laborers were used throughout the winter of 1935-36 in making city surveys and for eradication work in the larger areas of infestation, peak employment for the season was not reached until May. Since then an average of 4,000 security wage earners have been employed in the 17 States, with the result that approximately 49,253 square miles of area were covered in 1936 in the thirteen States comprising the original control area and 6,700 square miles in the four new States. A total of more than 68,500,000 barberry bushes were destroyed in 1936 on 11,512 different properties, 2,197,000 of which were located on 6,158 properties in the group of States where control work has been under way since 1918.

New States and Problems

The results of barberry eradication in the thirteen original grain-growing States in reducing the continuous annual drain of rust losses have been so pronounced that four additional States, at their own request, have been included in the program under the emergency allotments. These are Missouri, Pennsylvania, Virginia, and West Virginia. In the latter two States, Berberis canadensis is native and abundant. The work has also been extended into a section of Colorado not previously included, where B. fendleri is native and grows wild in the woods and valleys along the edges of the grain fields. The problem of destroying large patches and areas of native species has introduced a new feature into the problem, since the program has heretofore been confined largely to the destruction of the introduced B. vulgaris that had widely escaped from cultivation. As a result of the attack on these native species, more than 18,594,000 barberries were killed in West Virginia during the calendar year 1936 and 44,961,000 in Virginia. Also, 1,656,800 of the native species (B. fendleri) were destroyed in Colorado.

The barberry population of Missouri is not proving as great as in some of the other States in which initial work is being done, as only 8,804 were found in 1936. In Pennsylvania, however, where B. vulgaris has been permitted to escape from cultivation during the many generations since the original settlement of that State, 2,788,690 bushes and seedlings have been destroyed. The benefits of this work have already been especially notable on the oat crop which, in localities covered in 1935, escaped serious damage from rust in 1936 for the first time in many years.

Barberry eradication is largely accomplished by the use of common rock salt. This is used in such quantities that 3,929 tons were used during the calendar year 1936. The dense patches of native barberry in Colorado and in the grain-growing valleys of the Allegheny Mountains has made it desirable to look for less bulky chemicals than salt. In the case of B. fendleri in southern Colorado, for example, the solid masses of this plant require large quantities of salt per square rod to result in complete kill. All barberries sprout rather easily from the roots, but this western species is particularly prolific in that respect, and a multitude of sprouts develop the year following digging. Among the new chemicals tried, Atlacide applied as a spray and at the same time as a soil drench has proved particularly effective. Since the latter part of August, 20 relief laborers have been engaged in using this material in Colorado, operating knapsack sprayers. They use 8 pounds of Atlacide in 5 gallons of water to each square rod. Tests are also being made with salt in solution, using it as a soil drench, and the preliminary results indicate that possibly the dosage of salt when used in this manner can be reduced.

Rust Susceptibility Studies

Further studies on the susceptibility of various species of cultivated barberries have been continued, and also studies have been made of the ecology of the barberry for the purpose of obtaining a better understanding of the natural increase in the field. Several species which have heretofore been considered of doubtful classification have been placed in the proper class with respect to rust reaction. Approximately 160 species are now growing in the experimental plots in the Foreign Plant Introduction Garden at Bell, Maryland. It was also found that, under natural conditions, most of the barberry seed germinated the first year, although some remained dormant for a time and germinated as much as four to eight years later. It has been definitely established that common salt, generally used for killing the bushes, does not kill seed lying on the ground.

Nursery Inspection

As a result of applications received by the Division of Domestic Plant Quarantine, 23 nurseries were authorized to ship immune species of barberries into protected States. Approximately 4,200 susceptible barberries were eradicated as a result of this inspection and educational work. During the past year 140 specimens of barberry were sent in by State leaders, nursery inspectors, and nurserymen for identification and recommendation.

Educational Work

Largely during periods when considerable numbers of relief laborers are not available for intensive surveys over wide areas, the program has involved educational work in efforts to get as many of the general public and school children to looking for barberries as possible. This work has been systematized and is carried on a county at a time. As a result of work of this kind, more than 3,100 individuals have reported barberry locations, and in many instances the survey of the property and its environs has resulted in the finding of thousands of plants. Work of this type has been somewhat reduced during the past several years of intensive survey, but it is planned that further expansion of it will again be made in the States where it appears to be needed and desirable, whenever opportunity arises and where adequate amounts of relief labor for intensive surveys are not available. (December 30, 1936).

## CONTROL OF PHONY PEACH DISEASE

By B. M. Gaddis, Principal Plant Quarantine Administrator, Division of Domestic Plant Quarantines, Bureau of Entomology and Plant Quarantine.

### Early History and Progress of the Disease

About 50 years ago a few dwarfed peach trees were observed near Marshallville, Georgia. The trees were called "ponies" because of their small size and were thought to be a new variety. However, the number of trees showing the dwarfing tendency continued to increase, and growers finally came to regard "ponies", or "phonies" as they were later called, as diseased trees. By 1915 the growers became alarmed because of the continued spread of the disease, and assistance was requested from the United States Department of Agriculture.

In 1921 a Federal peach disease laboratory was established at Fort Valley, Georgia, and the disease became the subject of research activities which have continued to date. In 1928, after repeated experimental work, the disease was found to be caused by a root-borne virus.

### Distribution of the Disease

Prior to July 1, 1935, the phony peach disease has been found in Texas, Oklahoma, Louisiana, Missouri, Arkansas, Illinois, Tennessee, Mississippi, Alabama, Florida, Georgia, North Carolina, and South Carolina. Since that date infections have been found in Kentucky, Maryland, Indiana, and Pennsylvania. The infected counties are shown in the tabular statement (page 38).

### Allotments for Control Activities

In 1929 the first Federal appropriation for the control of phony peach disease became available and cooperative activities with the affected States were started. This work is still in progress, and since August 1935 the regular annual appropriations have been supplemented by fund allotted under the Emergency Relief Appropriation Acts.

### Control and Eradication Program

The control and eradication program, which is based on the fact that the disease can apparently be artificially disseminated only through the medium of shipments of infected nursery or root stock, and that its natural spread is relatively slow and local in scope, embraces the following functions:

1. Nursery sanitation. Eradication of diseased trees from the environs of all commercial nurseries in the affected States, thus preventing further long-distance artificial spread of the disease.

2. Annual surveys in States, bordering on the infected region, for the purpose of locating and eradicating any incipient infections; also thorough inspection in the known lightly infected area and eradication of diseased trees therein.

3. Concentrated eradication in and adjacent to the commercial orchards of the generally infected Gulf Coast States.

During the past season the environs of 422 nurseries in the infected States were thoroughly inspected and 104 of them were found to be exposed to the disease. Through concerted Federal and State effort all infected trees around all but one of these nursery properties were removed at the time of inspection or shortly thereafter.

During the past field season approximately 150 Federal and 50 State inspectors were employed. Surveys were carried on in every peach-growing State east and northeast of and including Texas and Arkansas, with the exception of Michigan, New York, and the New England States, and over 21,000,000 peach trees were inspected on 196,344 properties in 550 counties in 20 States; 156,977 infected trees were found, of which 146,072 were removed. All known diseased trees have been eradicated from nine States, namely, Arkansas, Illinois, Indiana, Louisiana, Maryland, Mississippi, Missouri, North Carolina, and Pennsylvania. Diseased trees to the number of 10,905 still remain to be removed from six States, namely, Alabama, Georgia, Kentucky, South Carolina, Tennessee, and Texas, and 10,422 of these trees are in Georgia. Before the winter season is over, it is believed, all known infected trees will be removed from all States except Georgia.

Surveys of the past season included 123 counties not previously inspected. Phony peach was found for the first time in one county each in Indiana and Pennsylvania. It was found for the first time in more than 50 counties in 12 of the States where the disease had previously existed. The progress of the control work is indicated by the fact that in 38 of the counties in which the disease previously existed no infection was found.

From August 1935 to December 31, 1936, approximately 52,000,000 abandoned and escaped peach trees have been removed from nearly 122,000 properties in 11 infected States. During this period the daily employment of relief labor under emergency relief funds has ranged from 1,200 to over 3,000 men.

## Present Status of Activities Against Phony Peach Disease

The program has now resulted in the accomplishment of economic control of the disease even in the heavily infected areas, and if the present program can be continued, it is not unreasonable to expect ultimate eradication. (January 22, 1937).

## Phony Peach Disease

Counties in which the disease was found in the field season of 1936, and in previous years, as shown by the annual report of the calendar year 1936, by E. A. Cavanagh, Project Leader.

### Alabama

| | | | | |
|---|---|---|---|---|
| *Autauga | Choctaw | *Escambia | Lowndes | Pickens |
| Barbour | Colbert | Geneva | *Macon | Pike |
| *Bibb | *Conecuh | Hale | Madison | Randolph |
| Bullock | *Coosa | Henry | Marengo | Shelby |
| Butler | Covington | Houston | Marshall | Sumter |
| *Calhoun | *Cullman | Jackson | Monroe | Talladega |
| *Chambers | Dallas | *Jefferson | *Montgomery | *Tallapoosa |
| Cherokee | DeKalb | *Lee | *Perry | *Tuscaloosa |
| *Chilton | *Elmore | | | |

### Arkansas

| | | | | |
|---|---|---|---|---|
| *Arkansas | *Craighead | *Howard | *Miller | *Saint Francis |
| *Ashley | Crittenden | Jefferson | *Nevada | Saline |
| *Bradley | *Cross | *Johnson | *Ouachita | Sebastian |
| *Chicot | *Desha | *Lafayette | *Phillips | *Sevier |
| Clark | *Drew | Lee | *Pike | *Union |
| Clay | Grant | *Lincoln | *Poinsett | White |
| *Columbia | *Greene | *Little River | Pope | Woodruff |
| Conway | *Hempstead | Lonoke | Pulaski | |

### Florida

| | | | | |
|---|---|---|---|---|
| Baker | Gadsden | Jackson | Leon | Ray |
| Columbia | Holmes | Jefferson | Madison | Suwanee |

* Infected in field season 1936.

## Georgia

| | | | | |
|---|---|---|---|---|
| Baldwin | Crisp | *Haralson | *Monroe | Taliaferro |
| Banks | *Dade | *Harris | *Morgan | *Taylor |
| *Barrow | *DeKalb | *Hart | *Murray | Telfair |
| *Bartow | Dodge | *Heard | *Muscogee | Terrell |
| Ben Hill | *Dooly | *Henry | *Newton | Tift |
| *Bibb | *Dougherty | *Houston | *Oconee | *Troup |
| *Bleckley | Douglas | Irwin | *Oglethorpe | Turner |
| Butts | Fannin | *Jackson | Paulding | *Twiggs |
| Campbell | *Fayette | *Jasper | *Peach | *Upson |
| *Carroll | *Floyd | *Jones | *Pike | *Walker |
| *Catoosa | Franklin | *Lamar | *Polk | Walton |
| *Chattooga | *Fulton | Laurens | *Pulaski | *Warren |
| Cherokee | Glascock | *Lee | *Putnam | *Washington |
| *Clarke | Gordon | Lincoln | Randolph | *Webster |
| *Clayton | Grady | *Lumpkin | *Richmond | Wheeler |
| *Cobb | Greene | *McDuffie | *Schley | White |
| Coffee | *Gwinnett | *Macon | *Spalding | *Whitfield |
| *Columbia | *Habersham | Madison | *Stewart | Wilcox |
| *Coweta | Hall | *Meriwether | *Sumter | Wilkes |
| *Crawford | *Hancock | Milton | *Talbot | |

## Illinois

| | | | | |
|---|---|---|---|---|
| *Alexander | *Jackson | *Johnson | *Pulaski | *Washington |
| *Franklin | *Jasper | *Marion | Richland | *Williamson |
| *Gallatin | *Jefferson | *Massac | *Union | |

## Indiana

*Gibson

## Kentucky

| | | | | |
|---|---|---|---|---|
| Bullitt | Henderson | *McCracken | Union | Webster |
| Graves | | | | |

## Louisiana

| | | | | |
|---|---|---|---|---|
| Avoyelles | *East Carroll | *Lincoln | Rapides | *Union |
| *Bienville | Evangeline | *Madison | Red River | *Webster |
| *Bossier | Franklin | *Morehouse | *Richland | *West Carroll |
| *Caddo | Grant | Natchitoches | Saint Tammany | Winn |
| *Claiborne | *Jackson | *Ouachita | | |

* Infected in field season 1936.

## Maryland

| | |
|---|---|
| Washington | Worcester |

## Mississippi

| | | | | |
|---|---|---|---|---|
| *Alcorn | Harrison | *Lincoln | *Pearl River | Walthall |
| Attala | *Hinds | Lowndes | *Prentiss | Warren |
| *Benton | Homes | Madison | Simpson | Washington |
| Calhoun | Jasper | *Marshall | Sunflower | Wayne |
| Clarke | Jones | Monroe | *Tate | Webster |
| Coahoma | Lamar | Montgomery | *Tippah | Wilkinson |
| Covington | Lauderdale | *Newton | *Tishomingo | Winston |
| *DeSoto | Leflore | *Oktibbeha | *Union | |

## Missouri

| | | | | |
|---|---|---|---|---|
| *Bollinger | *Dunklin | *Madison | *Pemiscot | *Saint Francois |
| *Butler | *Franklin | *Mississippi | *Perry | *Scott |
| *Cape Girardeau | Gasconade | *New Madrid | *Sainte Genevieve | *Stoddard |

## North Carolina

| | | | | |
|---|---|---|---|---|
| *Anson | *Cleveland | *Mecklenburg | Richmond | *Stanly |
| Caldwell | *Gaston | Montgomery | *Robeson | *Wake |
| Catawba | Iredell | Moore | *Rutherford | |

## Oklahoma

Bryan

## Pennsylvania

*Berks

## South Carolina

| | | | | |
|---|---|---|---|---|
| *Aiken | Charleston | *Edgefield | *Laurens | *Spartanburg |
| *Anderson | *Chester | *Florence | *Newberry | Sumter |
| Bamberg | *Chesterfield | *Greenville | Orangeburg | *Union |
| *Barnwell | *Colleton | *Greenwood | *Richland | *York |
| Calhoun | *Darlington | Hampton | *Saluda | |

* Infected in field season 1936.

Tennessee

| | | | | |
|---|---|---|---|---|
| Anderson | *Dickson | *Hardeman | *McNairy | *Rhea |
| *Bedford | *Dyer | *Hardin | *Marion | Roane |
| Bledsoe | *Fayette | Knox | Meigs | *Rutherford |
| *Bradley | *Franklin | *Lauderdale | *Polk | *Shelby |
| *Davidson | *Gibson | *Lawrence | *Putnam | *Warren |
| *DeKalb | *Hamilton | *Lincoln | | |

Texas

| | | | | |
|---|---|---|---|---|
| Anderson | *Comal | Henderson | *McLennan | Shelby |
| *Angelina | *Comanche | Hood | Medina | *Smith |
| Atascosa | Dallas | Hopkins | Milam | Tarrant |
| *Bexar | Denton | Houston | Nacogdoches | Titus |
| *Bowie | Ellis | Hunt | Palo Pinto | Travis |
| Brazos | *Erath | Jasper | Parker | Upshur |
| *Brown | Fayette | Kaufman | Robertson | Van Zandt |
| Cass | Franklin | Kendall | Rusk | Washington |
| *Cherokee | Gillespie | *Kerr | San Augustine | Wichita |
| Collin | Gregg | Lamar | *San Saba | Wood |
| Collingsworth | Hays | *Limestone | | |

Of the 227 counties in which the disease was found in 1936, more than 50 w r found infected for the first time.

## CITRUS CANKER ERADICATION

By B. M. Gaddis, Bureau of Entomology and Plant Quarantine.

### Introduction of the Disease into the United States

Citrus canker (caused by Bacterium citri), a very infectious and destructive bacterial disease of citrus, was apparently introduced from Japan on Citrus trifoliata rootstock in 1911, and during subsequent years it became established in seven States embracing the Gulf Coast citrus-producing area from Florida to Texas, inclusive.

### Results of Early Eradication Activities

As a result of Federal-State cooperative activities, eradication of the disease was apparently accomplished prior to 1928 in all infected States except in Louisiana and Texas, where it has persisted in the areas in which Satsuma orange production was undertaken on an extensive scale about 25 years ago.

* Infected in field season 1936.

## Results of Eradication Activities Since 1921

From 1921 to 1934, partly owing to the inadequacy of the inspection force, only 32 infected properties were found in Texas, and these were in places where the disease had previously existed and in which it was recurring.

Under a reorganization and expansion of personnel, made possible by supplemental emergency relief funds, 54 infected properties previously undiscovered and of long standing were located in Texas and Louisiana during 1935 and the first 9 months of 1936, or 19 more infected properties than were found during the preceding 13 years. These comprised over 900 trees in 4 parishes in Louisiana, and over 1,900 trees in 4 counties in Texas. During the past two years the disease has been found in Calcasieu, Lafourche, St. Charles, and Terrebonne Parishes in Louisiana, and in Brazoria, Galveston, Harris, and Jefferson Counties in Texas.

With the allotment from emergency relief funds it was possible to carry on such intensive inspection activities that the entire citrus-producing areas of Texas and Louisiana have been scouted, and it is believed that all infected areas have been located.

The inspection work has been supplemented by the eradication of more than 13,600,000 worthless, escaped, or abandoned citrus trees during the period from July 1, 1935, to December 31, 1936, thus removing a possible source from which the disease might eventually reach the commercial citrus-producing areas.

It was considered desirable to eradicate not only canker-infected plants but to destroy insofar as possible all hosts of the disease in the noncommercial infected areas in which large numbers of escaped *Citrus trifoliata* plants were growing wild in dense junglelike swamps and woodlands, many of which were found to be infected with canker.

Intensive inspection revealed the presence of citrus on 2,283 properties in the four infected Texas counties of Galveston, Brazoria, Harris, and Jefferson. All of these properties except 43 have been freed of citrus plants. At the present time the removal of citrus plants has been accomplished on over 98 percent of all citrus-growing properties in the known infected areas of Texas. The program, therefore, is aimed at the elimination insofar as possible of all worthless hosts of the disease outside the commercial areas.

Inspection and eradication activities were extended during 1936 to Alabama and Mississippi, where the disease is known to have existed. To date no infection has been found; however, approximately 2,000,000 worthless host plants have been destroyed.

## Use of Autogiro in Eradication of Citrus Canker

Incidental to completion of eradication activities in Louisiana, it was considered advisable to survey several hundred wooded islands, or moats as they are sometimes called, in the extensive marshland areas in the southern portion of the State, since it was known that citrus plants existed on some of these moats. The task was one of some concern, especially in view of the inaccessibility, either by boat or land, to many such sites. The problem was, however, successfully solved by the use of an autogiro loaned by the Dutch elm disease project.

The autogiro was used in scouting over this extensive swamp area at a time when citrus trees were in flower and therefore easily distinguished from other vegetation. Approximately 600 such trees were found on 24 of the moats. Ground crews were sent to the recorded locations to inspect carefully for infection, and on one such area, which could be reached by boat and mud scow only, rather heavy canker infection, which had apparently existed for many years, was found and destroyed. This is an excellent illustration of the value of the autogiro in plant-disease-eradication work.

## Present Status of Eradication Activities

Accomplishments of the activity in which the affected States have cooperated indicate that the use of emergency relief funds has marked the difference between eradication at an early date and a prolonged program.

In order to perpetuate the achievements of the emergency program and to complete eradication of citrus canker, it will be necessary to recheck the sites from which trees have been removed, to destroy seedlings and sprouts which may appear thereafter, and to reinspect the remaining citrus plantings in the vicinity of old infections. All such sites are accurately recorded and mapped for the purpose of simplifying and expediting economic and thorough reinspections. (January 22, 1937).

## Citrus Canker

Counties in which the disease has been found in the field season of 1936 and the previous years, as shown by the summary of the campaign dated November 24, 1933, and subsequent records.

| States | Years During Which Infections Were Found | Counties | | |
|---|---|---|---|---|
| Alabama | 1916 - 1923 | Baldwin | Mobile | |
| | | Escambia | Washington | |
| Florida | 1914 - 1927 | Baker | Hardee | Palm Beach |
| | | Bay | Highlands | Pasco |
| | | Brevard | Hillsborough | Pinellas |
| | | Broward | Indian River | Santa Rosa |
| | | Dade | Jefferson | Seminole |
| | | De Soto | Lake | St. Lucie |
| | | Duval | Lee | St. Johns |
| | | Escambia | Marion | Suwannee |
| | | Flagler | Okaloosa | Walton |
| | | Glades | | |
| Georgia | 1916 - 1917 | Appling | Echols | Randolph |
| | | Berrien | Glynn | Terrell |
| | | Brooks | Grady | Thomas |
| | | Bryan | Irwin | Ware |
| | | Decatur | Lowndes | Wayne |
| Louisiana | 1916 - 1936 | Acadia | Jefferson Davis | St. James |
| | | Ascension | Lafayette | St. John |
| | | Assumption | *Lafourche | St. Tammany |
| | | *Calcasieu | Orleans | Tangipahoa |
| | | Iberia | Plaquemines | *Terrebonne |
| | | Jefferson | St. Bernard | Vermilion |
| | | | *St. Charles | St. Landry |
| Mississippi | 1917 - 1918 | George | Jackson | |
| | | Harrison | Stone | |
| South Carolina | 1916 | Charleston | | |
| Texas | 1916 - 1936 | Bee | Fort Bend | Kleberg |
| | | *Brazoria | *Galveston | Matagorda |
| | | Brooks | *Harris | Nueces |
| | | Cameron | Hidalgo | Orange |
| | | Chambers | Jackson | San Patricio |
| | | Colorado | *Jefferson | Victoria |
| | | Duval | Jim Wells | Webb |

* Infections found during the years 1935 and 1936.

# ERADICATION OF THE PEACH MOSAIC DISEASE

By B. M. Gaddis, Bureau of Entomology and Plant Quarantine.

## Discovery of the Disease and Present Distribution

Peach mosaic, the newest of the five major virus diseases of peach, was first observed at Brownwood, Texas, in 1931 by Federal phony peach inspectors and identified by Dr. Lee M. Hutchins, of the Bureau of Plant Industry, as a previously unknown virus disease. In the summer of 1934 the disease was also reported from Colorado, where it had apparently been established for 4 or 5 years. It is now known to be present also in Utah, California, Arizona, and New Mexico. There are 39 infected counties in these 6 southwestern States. These counties are listed in a supplemental tabular statement (page 46).

## Nature of the Disease

Peach mosaic is an infectious virus disease which may be transmitted by budwood or by patch-bark grafts from either twig or root bark. The incubation period is apparently less than 12 months, and the natural spread is very rapid and generally occurs in colony formation.

## Progress of Survey and Eradication Activities

Eradication was begun by Colorado State authorities early in 1935, and in August of that year funds from the Emergency Relief Appropriation Act were secured to conduct an eradication program in Colorado and to make surveys in other nearby States. In 1936, under additional allotments from emergency relief funds, the eradication program was extended to include California, Texas, and Utah.

Intensive cooperative surveys carried on in the known infected States and in bordering States in 1935 and 1936 resulted in the inspection of over 4,000,000 trees on 17,000 properties in 171 counties.

The peach mosaic disease was found to be present in 3 counties in California, 1 in Arizona, 10 in New Mexico, 20 in Texas, 2 in Utah, and 3 in Colorado. No peach mosaic disease was found in Iowa, Kansas, or Nebraska.

The inspection and eradication program is being carried on under Federal supervision in cooperation with State pest-control officials. During the field season of 1936, 47,713 mosaic-infected peach trees were found in the infected States. All diseased trees have been removed in Colorado and Utah, and removal of such trees is now under way in California and Texas, and the work will be extended to Arizona and New Mexico in the spring of 1937.

The disease was discovered in California in 1933, but was not determined as "mosaic" until the spring of 1936. The work of approximately 75 inspectors during July to November of the past year revealed infection in the counties of San Diego, Riverside, and San Bernardino. The disease was found to be especially concentrated in the peach-growing areas of Riverside and San Bernardino Counties, where it centered around Redlands and Beaumont. Inspection revealed a total of 29,447 infected trees on 835 properties.

Present Status of Eradication Activities

The project has a rather favorable status at present. However, in view of the incubation period of the disease, there still exist infected trees on which symptoms will not be visible at least until next spring. In order to carry this program through to a point which will protect accomplishments to date, it will, therefore, be necessary to reinspect all known infected properties next season and to continue intensive surveys in the States in which infection is known to exist, as well as in adjoining States, in order that information relative to the spread of the disease may be known and eradication may be accomplished. Under a continued program on this basis, it is not unreasonable to expect ultimate eradication of the peach mosaic disease. (January 22, 1937).

Peach Mosaic

States and counties found to be infected, 1931 to 1936. All these counties were found infected in surveys in the field season 1936.

Arizona

Coconino

California

Riverside
San Bernardino
San Diego

Colorado

Garfield
Mesa
Montezuma

New Mexico

Bernalillo
Dona Ana
Lincoln
Otero
Rio Arriba
Sandoval
Santa Fe
Sierra
Socorro
Valencia

Texas

Bexar
Bowie
Brown
Callahan
Childress
Comanche
Eastland
El Paso
Fayette
Grayson
Kerr
Limestone
Mills
Palo Pinto
San Saba
Smith
Stephens
Wheeler
Wichita
Wilbarger

Utah

Grand
Washington

# CROP LOSSES FROM PLANT DISEASES IN THE UNITED STATES IN 1936

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CONTENTS

FOREWORD

These estimates have been computed and are presented in the same manner as in previous years (Plant Disease Reporter Supplement 94, 1936). Additions and corrections will be gladly received and revisions will be published in the Reporter.

It may be well to call attention again to the fact that States from which no estimates for a particular crop are received are left out of the calculations for the percentage loss for the country as a whole. This results in a figure that may in some cases be greater, in others smaller, depending upon the crop and the disease, than would be the case if estimates were available from all States. Such completeness is at present not attainable and it is thought that a figure more representative for the country as a whole is obtained in this manner than if the estimates were diluted with the production for States not reporting.

The fact that these estimates are not claimed to be exact may also be emphasized again. In some cases, it is true, counts have been made on which a fairly accurate estimate can be based. In most cases, however, the figures are the result of the combined judgment of pathologists in the various States, based upon their individual observations and reports they have received. If these estimates are sincerely made they do permit comparison of one year with another, which is their main purpose and is all that is claimed for them. If we wait until really exact estimates are obtainable, a record that is of considerable comparative value will have been lost in the meantime.

Comparison of these estimates with those for 1935 show some considerable variations. Some of the more interesting are as follows:

| Crop and Disease | Percent loss 1935 | 1936 |
|---|---|---|
| Wheat, stem rust | 23. | 0.4 |
| Barley, stem rust | 10. | t |
| Barley, scab | 3.5 | t |
| Oats, crown rust | 8. | 0.5 |
| Field corn, ear rots except Diplodia | 2.8 | 7.6 |
| Field corn, stalk rots except Diplodia | 1.1 | 3.3 |
| Field corn, Diplodia | 1.3 | 2.5 |
| Apple, scab | 14.1 | 2.8 |
| Pear, blight | 13.6 | 1.6 |
| Peach, leaf curl | 4.3 | 0.2 |
| Cherry, leaf spot | 11.9 | 0.4 |
| Grape, black rot | 8.5 | 3.1 |

Table 1. Estimated reduction in yield of wheat due to scab (Gibberella saubinetii), leaf rust (Puccinia rubigo-vera tritici), stem rust (P. graminis), bunt (Tilletia spp.), loose smut (Ustilago tritici), foot rots (various organisms), and other diseases, 1936.

| State | Production: 1,000 Bushels | Scab | | Leaf Rust | | Stem Rust | | Bunt | | Loose Smut | | Foot Rots | | All Diseases | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels |
| Maine | 119 | t | + | - | - | t | + | - | - | - | - | - | - | t | + |
| Mass. | | - | - | t | + | 1. | + | - | - | - | - | t | + | 5. | + |
| *N. Y. | 5,743 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *N. J. | 1,281 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pa. | 19,615 | t | + | 13. | 3,368 | 1.5 | 389 | 5.3 | 1,373 | 2.5 | 648 | t | + | 24.3 | 6,296 |
| Ohio | 40,278 | t | + | 0.1 | 41 | t | + | 1. | 409 | 0.5 | 205 | - | - | 1.6 | 655 |
| Ind. | 31,042 | 0. | 0 | 0. | 0 | t | + | t | + | 1. | 314 | 0. | 0 | 1. | 314 |
| Ill. | 36,435 | 0. | 0 | 0.5 | 196 | t | + | t | + | 0.9 | 352 | t | + | 6.9 | 2,700 |
| Mich. | 16,702 | 0.1 | 19 | 0.1 | 19 | t | + | 5. | 932 | 5. | 932 | 0.1 | 19 | 10.4 | 1,940 |
| Wis. | 1,469 | t | + | 5. | 80 | t | + | 1. | 16 | t | + | t | + | 8. | 128 |
| Minn. | 18,721 | 0. | 0 | t | + | t | + | 0.5 | 96 | 1. | 192 | 1. | 192 | 2.5 | 480 |
| Iowa | 9,440 | 0.5 | 52 | 1. | 104 | 0.5 | 52 | 1. | 104 | t | + | 1. | 104 | 9. | 935 |
| Mo. | 31,407 | - | - | t | + | t | + | - | - | 4. | 1,309 | - | - | 4. | 1,309 |
| N. D. | 19,235 | t | + | t | + | t | + | 0.3 | 59 | 0.4 | 78 | 1. | 196 | 1.7 | 333 |
| S. D. | 4,286 | - | - | t | + | t | + | - | - | - | - | - | - | t | + |
| Nebr. | 47,339 | - | - | t | + | t | + | - | - | 1. | 478 | - | - | 1. | 478 |
| Kans. | 120,270 | t | + | 0.2 | 248 | 0.5 | 621 | 0.3 | 373 | 0.2 | 248 | 2. | 2,485 | 3.2 | 3,975 |
| Del. | 1,419 | t | + | 0.5 | 7 | - | - | t | + | t | + | - | - | 1. | 14 |
| Md. | 8,980 | 1. | 94 | 0.7 | 66 | 0. | 0 | 2. | 188 | 1. | 94 | - | - | 4.7 | 442 |
| Va. | 7,862 | 0.5 | 43 | 2.5 | 217 | 2. | 174 | 1. | 87 | 2. | 174 | 0.5 | 43 | 9.5 | 825 |
| W. Va. | 2,025 | t | + | 0.5 | 11 | 1. | 23 | 2. | 45 | 2. | 45 | 3. | 68 | 10. | 226 |
| N. C. | 5,194 | 2. | 124 | 3. | 185 | - | - | 1. | 62 | 2. | 124 | 3. | 185 | 16. | 989 |
| *S. C. | 1,472 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ga. | 1,560 | - | - | 5. | 87 | 0.1 | 2 | 0.1 | 2 | 2. | 35 | - | - | 10.2 | 178 |
| Ky. | 5,894 | t | + | t | + | t | + | - | - | 2. | 122 | - | - | 3. | 183 |
| *Tenn. | 4,858 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ala. | 54 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Wheat (Continued)

| State | Production 1,000 Bushels | Scab % | Scab 1,000 Bushels | Leaf Rust % | Leaf Rust 1,000 Bushels | Stem Rust % | Stem Rust 1,000 Bushels | Bunt % | Bunt 1,000 Bushels | Loose Smut % | Loose Smut 1,000 Bushels | Foot Rots % | Foot Rots 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ark. | 595 | - | - | t | + | t | + | t | + | 1. | 6 | - | - | 1. | 6 |
| Okla. | 27,520 | 0.5 | 155 | 1.5 | 464 | t | + | 3. | 928 | 2. | 618 | 1. | 309 | 11. | 3,402 |
| Texas | 18,927 | t | + | 2. | 421 | t | + | 0.1 | 21 | 2. | 421 | 4. | 842 | 10.1 | 2,126 |
| Mont. | 13,626 | 0. | 0 | t | + | t | + | 2. | 288 | 0.3 | 43 | 3. | 432 | 5.3 | 763 |
| Idaho | 21,096 | 0. | 0 | t | + | 2. | 454 | 5. | 1,134 | - | - | t | + | 7. | 1,588 |
| Wyo. | 1,164 | 0. | 0 | t | + | t | + | 1.5 | 18 | t | + | t | + | 1.5 | 18 |
| Colo. | 10,691 | 0. | 0 | t | + | 1. | 111 | 3. | 334 | t | + | 0. | 0 | 4. | 445 |
| *N. M. | 1,023 | 0. | 0 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ariz. | 1,104 | 0. | 0 | - | - | - | - | - | - | - | - | - | - | - | - |
| Utah | 4,477 | 0. | 0 | 0. | 0 | 5. | 259 | 5. | 259 | 2. | 104 | 0.5 | 26 | 13.5 | 700 |
| *Nev. | 274 | 0. | 0 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Wash. | 46,193 | 0. | 0 | - | - | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 20,340 | 0. | 0 | 0.1 | 22 | t | + | 2. | 432 | t | + | 3.5 | 757 | 5.9 | 1,276 |
| *Calif. | 16,731 | 0. | 0 | - | - | - | - | - | - | - | - | - | - | - | - |
| U. S. | 626,461 | 0.1 | 487 | 1. | 5,536 | 0.4 | 2,085 | 1.2 | 7,160 | 1.1 | 6,542 | 1. | 5,658 | 5.7 | 32,724 |

* Omitted in calculations for U. S. percentage loss.

Table 2. Estimated reduction in yield of barley due to stripe (Helminthosporium gramineum), spot blotch (Pyrenophora teres), loose smut (Ustilago spp.), covered smut (Ustilago hordei), scab (Gibberella saubinetii), stem rust (Puccinia graminis), and other diseases, 1936.

| State | Production | Estimated reduction in yield of barley due to diseases | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Stripe | | Spot Blotch | | Loose Smut | | Covered Smut | | Scab | | Stem Rust | | All Diseases | |
| | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels |
| *Maine | 140 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Vt. | 140 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mass. | | 0. | 0 | 0. | 0 | 1. | + | t | + | - | - | 1. | + | 5. | + |
| Conn. | | - | - | - | - | 0.5 | + | 0.5 | + | - | - | - | - | 1. | + |
| *N. Y. | 2,718 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *N. J. | 22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pa. | 1,764 | 0.5 | 10 | 1. | 20 | 2.3 | 46 | 6.7 | 134 | t | + | t | + | 11.5 | 230 |
| Ohio | 520 | 1. | 5 | - | - | 0.1 | 1 | t | + | t | + | t | + | 1.1 | 6 |
| Ind. | 380 | t | + | - | - | t | + | t | + | - | - | 0. | 0 | t | + |
| *Ill. | 2,700 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Mich. | 3,580 | 0.1 | 4 | 0.1 | 4 | 0.2 | 7 | 0.2 | 7 | 0.1 | 4 | t | + | 0.7 | 26 |
| Wis. | 17,896 | 0.5 | 95 | 1. | 191 | 3. | 572 | 0.7 | 134 | t | + | t | + | 6.2 | 1,183 |
| Minn. | 31,620 | 0.5 | 165 | t | + | 1. | 329 | 1.5 | 494 | 0. | 0 | 0. | 0 | 4. | 1,317 |
| Iowa | 7,056 | 3. | 231 | 1. | 77 | 0.5 | 39 | 1. | 77 | t | + | t | + | 8.5 | 655 |
| Mo. | 1,360 | - | - | - | - | 4. | 57 | 1. | 14 | t | + | 0. | 0 | 5. | 71 |
| N. D. | 4,522 | t | + | t | + | 0.5 | 23 | t | + | 0. | 0 | 0. | 0 | 1. | 46 |
| S. D. | 8,977 | 3. | 281 | - | - | 1. | 94 | t | + | - | - | 0. | 0 | 4. | 375 |
| *Nebr. | 5,520 | - | - | - | - | - | - | - | - | - | - | t | + | - | - |
| Kans. | 4,004 | t | + | t | + | 3. | 133 | 7. | 311 | t | + | t | + | 10. | 444 |
| Del. | | t | + | - | - | - | - | t | + | - | - | - | - | - | - |
| Md. | 1,000 | 0.5 | 5 | - | - | 2. | 22 | 3. | 32 | 2. | 22 | t | + | 7.5 | 81 |
| Va. | 900 | 3. | 31 | 1. | 10 | 3. | 31 | 2.5 | 26 | t | + | 1.5 | 15 | 12. | 123 |
| W. Va. | 112 | 1. | 1 | - | - | 2.5 | 3 | 3. | 4 | - | - | t | + | 8.5 | 10 |
| N. C. | 153 | 1. | 2 | 1. | 2 | 2. | 3 | 1. | 2 | 1. | 2 | - | - | 8. | 14 |
| Ga. | | 0.1 | + | - | - | 1. | + | 2. | + | - | - | - | - | 5.1 | + |
| Ky. | 440 | - | - | - | - | 3. | 14 | 3. | 14 | t | + | t | + | 6. | 28 |

Barley (Continued)

| State | Production 1,000 Bushels | Stripe % | Stripe 1,000 Bushels | Spot Blotch % | Spot Blotch 1,000 Bushels | Loose Smut % | Loose Smut 1,000 Bushels | Covered Smut % | Covered Smut 1,000 Bushels | Scab % | Scab 1,000 Bushels | Stem Rust % | Stem Rust 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimated reduction in yield of barley due to diseases | | | | | | | | | | | | | |
| *Tenn. | 432 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ark. | | t | + | - | - | 8. | + | 1. | + | - | - | t | + | 10. | + |
| *Okla. | 780 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Texas | 1,246 | 0.5 | 7 | 0.1 | 1 | 2. | 27 | 0.5 | 7 | 1. | 13 | t | + | 7.1 | 95 |
| Mont. | 798 | 1. | 9 | 0. | 0 | 1. | 9 | 2. | 17 | 0. | 0 | 0. | 0 | 8. | 70 |
| Idaho | 3,432 | t | + | 0. | 0 | 0. | 0 | 0.5 | 17 | 0. | 0 | - | - | 0.5 | 17 |
| Wyo. | 770 | t | + | - | - | t | + | 2. | 16 | - | - | t | + | 3. | 24 |
| Colo. | 6,660 | t | + | 0. | 0 | 3. | 213 | 3. | 213 | 0. | 0 | t | + | 6. | 426 |
| *N. M. | 126 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ariz. | 726 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Utah | 1,739 | t | + | - | - | - | - | 2. | 36 | - | - | t | + | 3.5 | 63 |
| *Nev. | 224 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Wash. | 2,100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 2,970 | t | + | 0.3 | 9 | t | + | 0.2 | 6 | - | - | t | + | 5.5 | 172 |
| *Calif. | 29,925 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| U. S. | 147,452 | 0.8 | 846 | 0.3 | 314 | 1.5 | 1,623 | 1.5 | 1,561 | t | 41 | t | 15 | 5.1 | 5,476 |

* Omitted in calculations for U. S. percentage loss.

RYE

Table 3. Estimated reduction in yield of rye due to smut (*Urocystis occulta*), ergot (*Claviceps purpurea*), leaf rust (*Puccinia rubigo-vera secalis*), stem rust (*P. graminis*), and other diseases, 1936.

| State | Production 1,000 Bushels | Smut % | Smut 1,000 Bushels | Ergot % | Ergot 1,000 Bushels | Leaf Rust % | Leaf Rust 1,000 Bushels | Stem Rust % | Stem Rust 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mass. | | 0. | 0 | 1. | + | 1. | + | 2. | + | 7. | + |
| R. I. | | - | - | - | - | 5. | + | - | - | 5. | + |
| Conn. | | - | - | - | - | 1. | + | - | - | 2. | + |
| *N.Y. | 304 | - | - | - | - | - | - | - | - | - | - |
| *N.J. | 368 | - | - | - | - | - | - | - | - | - | - |
| Pa. | 1,260 | t | + | t | + | 6. | 85 | t | + | 11. | 156 |
| Ohio | 702 | t | + | 0.1 | + | 0.5 | 4 | t | + | 0.6 | 4 |
| Ind. | 1,188 | 0. | 0 | t | + | 0. | 0 | 0. | 0 | t | + |
| Ill. | 862 | t | + | 0. | 0 | t | + | 0. | 0 | t | + |
| Mich. | 1,622 | t | + | t | + | t | + | t | + | 0.5 | 8 |
| Wis. | 2,100 | t | + | t | + | 3. | 65 | t | + | 3.5 | 76 |
| Minn. | 4,325 | t | + | t | + | 0. | 0 | 0. | 0 | t | + |
| Iowa | 1,050 | t | + | t | + | t | + | t | + | 1. | 11 |
| Mo. | 225 | - | - | - | - | t | + | 0. | 0 | t | + |
| N. D. | 2,448 | 0. | 0 | t | + | 0. | 0 | 0. | 0 | t | + |
| S. D. | 1,608 | - | - | 2. | 33 | - | - | 0. | 0 | 2. | 33 |
| *Nebr. | 3,442 | - | - | - | - | - | - | 0. | 0 | - | - |
| Kans. | 609 | - | - | - | - | 0. | 0 | 0. | 0 | 0. | 0 |
| Del. | 46 | - | - | - | - | t | + | - | - | t | + |
| *Md. | 188 | - | - | - | - | - | - | - | - | - | - |
| Va. | 418 | - | - | t | + | 1. | 4 | 1. | 4 | 2.5 | 10 |
| W. Va. | 104 | t | + | t | + | 0.5 | + | 0. | 0 | 4. | 4 |
| N. C. | 390 | - | - | - | - | t | + | - | - | 8. | 34 |
| *S. C. | 75 | - | - | - | - | - | - | - | - | - | - |
| Ga. | 99 | - | - | - | - | 0.1 | + | - | - | 3.1 | 3 |
| *Ky. | 198 | - | - | - | - | - | - | - | - | - | - |
| *Tenn. | 176 | - | - | - | - | - | - | - | - | - | - |
| Ark. | | - | - | - | - | t | + | t | + | t | + |
| *Okla. | 144 | - | - | - | - | - | - | - | - | - | - |
| Texas | 28 | t | + | 0. | 0 | 1. | + | t | + | 6. | 2 |
| Mont. | 90 | 0. | 0 | t | + | 0. | 0 | 0. | 0 | t | + |
| *Idaho | 88 | - | - | - | - | - | - | - | - | - | - |
| Wyo. | 138 | - | - | - | - | - | - | t | + | t | + |
| *Colo. | 232 | - | - | - | - | - | - | 0. | 0 | - | - |
| *Utah | 12 | - | - | - | - | - | - | - | - | - | - |
| *Wash. | 189 | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 700 | 0. | 0 | t | + | 0.1 | 1 | t | + | 0.4 | 3 |
| *Calif. | 126 | - | - | - | - | - | - | - | - | - | - |
| U. S. | 25,554 | t | + | 0.2 | 33 | 0.8 | 159 | t | 4 | 1.7 | 344 |

*Omitted in calculations for U. S. percentage loss.

Table 4. Estimated reduction in yield of oats due to smuts (Ustilago avenae and U. levis), stem rust (Puccinia graminis), crown rust (P. coronata), and other diseases, 1936.

| State | Production: 1,000 Bushels | Smuts % | Smuts 1,000 Bushels | Stem Rust % | Stem Rust 1,000 Bushels | Crown Rust % | Crown Rust 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|
| Maine | 4,130 | 5. | 217 | - | - | - | - | 5. | 217 |
| N.H. | 342 | 1. | 3 | - | - | - | - | 1. | 3 |
| *Vt. | 2,048 | - | - | - | - | - | - | - | - |
| Mass. | 170 | 5. | 9 | 1. | 2 | t | + | 6. | 11 |
| *R.I. | 64 | - | - | - | - | - | - | - | - |
| Conn. | 162 | 2. | 3 | - | - | 1. | 2 | 3.5 | 6 |
| *N.Y. | 18,392 | - | - | - | - | - | - | - | - |
| *N.J. | 1,568 | - | - | - | - | - | - | - | - |
| Pa. | 24,009 | 10. | 2,760 | t | + | t | + | 13. | 3,588 |
| Ohio | 40,535 | 3.5 | 1,470 | t | + | t | + | 3.5 | 1,470 |
| Ind. | 38,502 | 2. | 786 | t | + | - | - | 2. | 786 |
| Ill. | 99,608 | 1.5 | 1,660 | t | + | 0.5 | 553 | 10. | 11,067 |
| Mich. | 32,181 | 1.5 | 491 | t | + | 0.1 | 33 | 1.7 | 557 |
| Wis. | 59,520 | 5. | 3,166 | t | + | 1. | 633 | 6. | 3,799 |
| Minn. | 94,376 | 3. | 2,934 | t | + | 0. | 0 | 3.5 | 3,423 |
| Iowa | 161,955 | 2. | 3,428 | 0.5 | 857 | t | + | 5.5 | 9,426 |
| Mo. | 29,330 | 10. | 3,259 | t | + | t | + | 10. | 3,259 |
| N.D. | 4,730 | t | + | t | + | t | + | 0.5 | 24 |
| S.D. | 12,712 | 1. | 128 | t | + | t | + | 1. | 128 |
| *Nebr. | 19,067 | - | - | t | + | - | - | - | - |
| Kans. | 32,186 | 20. | 8,047 | t | + | t | + | 20. | 8,047 |
| Del. | 61 | 0.5 | + | - | - | t | + | 0.5 | + |
| Md. | 1,131 | 5. | 61 | t | + | 2. | 24 | 7. | 85 |
| Va. | 1,287 | 3.5 | 49 | 1.5 | 21 | 2.5 | 35 | 8. | 112 |
| W.Va. | 1,206 | 5. | 65 | t | + | 1. | 13 | 7. | 91 |
| N.C. | 3,430 | 2. | 75 | - | - | 3. | 113 | 9. | 339 |
| *S.C. | 8,473 | - | - | - | - | - | - | - | - |
| Ga. | 6,948 | 3. | 229 | - | - | 4. | 305 | 9. | 687 |
| *Fla. | 128 | - | - | - | - | - | - | - | - |
| Ky. | 1,053 | 5. | 55 | 0. | 0 | t | + | 5. | 55 |
| *Tenn. | 924 | - | - | - | - | - | - | - | - |
| *Ala. | 1,870 | - | - | - | - | - | - | - | - |
| *Miss. | 1,300 | - | - | - | - | - | - | - | - |
| Ark. | 3,075 | 2. | 63 | t | + | t | + | 2. | 63 |
| La. | 1,120 | 1. | 13 | 3.5 | 46 | 10. | 132 | 15. | 198 |
| Okla. | 20,320 | 10. | 2,322 | t | + | 1.5 | 348 | 12.5 | 2,902 |
| Texas | 22,552 | 4. | 1,074 | t | + | 8. | 2,148 | 16. | 4,296 |
| Mont. | 2,244 | 5. | 122 | 0. | 0 | 0. | 0 | 8. | 195 |
| Idaho | 4,716 | t | + | t | + | 0. | 0 | t | + |
| Wyo. | 1,474 | 5. | 78 | t | + | - | - | 5. | 78 |
| Colo. | 4,256 | 5. | 224 | t | + | t | + | 5. | 224 |
| *N.M. | 400 | - | - | - | - | - | - | - | - |
| *Ariz. | 300 | - | - | - | - | - | - | - | - |
| Utah | 1,080 | 2. | 22 | t | + | - | - | 2.5 | 28 |
| *Nev. | 76 | - | - | - | - | - | - | - | - |
| *Wash. | 8,517 | - | - | - | - | - | - | - | - |
| Oreg. | 11,492 | 0.4 | 49 | 1.5 | 185 | 1.5 | 185 | 6.6 | 813 |
| *Calif. | 4,080 | - | - | - | - | - | - | - | - |
| U. S. | 789,100 | 3.9 | 32,862 | 0.1 | 1,111 | 0.5 | 4,524 | 6.6 | 55,977 |

* Omitted in calculations for U. S. percentage loss.

Table 5. Estimated reduction in yield of field corn due to smut (Ustilago zeae), root rots (various organisms), ear rots and stalk rots (various organisms other than Diplodia), ear and stalk rots (Diplodia zeae), bacterial wilt (Aplanobacter stewarti), and other diseases, 1936.

| State | Production 1,000 Bushels | Smut % | Smut 1,000 Bushels | Root Rots % | Root Rots 1,000 Bushels | Ear Rots (except Diplodia) % | Ear Rots (except Diplodia) 1,000 Bushels | Stalk Rots (except Diplodia) % | Stalk Rots (except Diplodia) 1,000 Bushels | Diplodia % | Diplodia 1,000 Bushels | Bacterial Wilt % | Bacterial Wilt 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Maine | 468 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| *N. H. | 656 | t | + | - | - | - | - | - | - | - | - | - | - | - | - |
| *Vt. | 2,964 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mass. | 1,638 | 2. | 35 | 2. | 35 | t | + | t | + | 2. | 35 | 0. | 0 | 6. | 105 |
| *R. I. | 342 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Conn. | 1,933 | 2. | 40 | - | - | - | - | - | - | - | - | - | - | 2.5 | 50 |
| *N. Y. | 19,840 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *N. J. | 7,373 | - | - | - | - | - | - | - | - | t | + | - | - | - | - |
| Pa. | 54,572 | 4. | 2,662 | t | + | 8. | 5,324 | 5. | 3,328 | t | + | t | + | 18. | 11,980 |
| Ohio | 121,605 | 3.5 | 4,528 | t | + | 1. | 1,294 | 1. | 1,294 | 0.5 | 647 | t | + | 6. | 7,763 |
| Ind. | 115,413 | 0.5 | 614 | 2. | 2,456 | 1.5 | 1,842 | 1. | 1,228 | 1. | 1,228 | - | - | 6. | 7,368 |
| Ill. | 217,751 | 3.7 | 14,569 | 6. | 23,626 | 23.5 | 92,534 | 10. | 39,376 | 1.5 | 5,906 | 0. | 0 | 44.7 | 176,011 |
| Mich. | 36,750 | 4.5 | 1,744 | - | - | 0.4 | 155 | - | - | 0.3 | 116 | 0. | 0 | 5.2 | 2,015 |
| Wis. | 44,080 | 1.5 | 715 | t | + | 1. | 477 | 5. | 2,383 | t | + | 0. | 0 | 7.5 | 3,575 |
| Minn. | 88,331 | 7. | 6,758 | 1. | 965 | 0.5 | 483 | t | + | t | + | 0. | 0 | 8.5 | 8,206 |
| Iowa | 212,240 | 5. | 13,433 | 3. | 8,060 | 3. | 8,060 | 0. | 0 | 10. | 26,866 | 0. | 0 | 21. | 56,419 |
| *Mo. | 40,032 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| N. D. | 2,530 | 1. | 26 | t | + | 0.5 | 13 | 0.5 | 13 | - | - | 0. | 0 | 2. | 52 |
| S. D. | 8,446 | 10. | 1,030 | - | - | 8. | 824 | - | - | - | - | 0. | 0 | 18. | 1,854 |
| *Nebr. | 26,859 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Kans. | 11,036 | 1. | 112 | t | + | 0.5 | 56 | t | + | 0. | 0 | 0. | 0 | 1.5 | 168 |
| Del. | 4,118 | t | + | 1. | 42 | 0.5 | 21 | - | - | t | + | - | - | 1.5 | 63 |
| Md. | 18,396 | - | - | 2. | 387 | 1.5 | 290 | 1. | 194 | 0.5 | 97 | t | + | 5. | 968 |
| Va. | 30,014 | 3. | 995 | 1. | 332 | 1. | 332 | 1.5 | 497 | 1. | 332 | 0.5 | 166 | 9.5 | 3,151 |
| W. Va. | 11,569 | 2. | 284 | 10. | 1,420 | 3. | 426 | 1. | 142 | 0.5 | 71 | - | - | 18.5 | 2,627 |

Field Corn (Continued)

| State | Production 1,000 Bushels | Smut % | Smut 1,000 Bushels | Root Rots % | Root Rots 1,000 Bushels | Ear Rots (except Diplodia) % | Ear Rots (except Diplodia) 1,000 Bushels | Stalk Rots (except Diplodia) % | Stalk Rots (except Diplodia) 1,000 Bushels | Diplodia % | Diplodia 1,000 Bushels | Bacterial Wilt % | Bacterial Wilt 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N. C. | 43,475 | 3. | 1,553 | 2. | 1,035 | 2. | 1,035 | 3. | 1,553 | t | + | - | - | 16. | 8,281 |
| *S. C. | 23,635 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ga. | 33,624 | 3. | 1,173 | 3. | 1,173 | 1. | 391 | 1. | 391 | 2. | 782 | - | - | 14. | 5,474 |
| *Fla. | 7,029 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ky. | 54,486 | 1. | 559 | - | - | t | + | t | + | 1.5 | 838 | - | - | 2.5 | 1,397 |
| *Tenn. | 57,160 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ala. | 41,162 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Miss. | 39,570 | 2. | 808 | - | - | - | - | - | - | - | - | - | - | 2. | 808 |
| *Ark. | 26,738 | t | + | - | - | - | - | - | - | - | - | - | - | - | - |
| La. | 20,734 | 0.5 | 104 | - | - | - | - | - | - | - | - | - | - | 0.5 | 104 |
| Okla. | 11,772 | 1. | 133 | 0.5 | 67 | 3. | 399 | 1. | 133 | 3. | 399 | - | - | 11.5 | 1,530 |
| Texas | 63,915 | 0.5 | 392 | 3. | 2,353 | 8. | 6,274 | 3. | 2,353 | 2. | 1,568 | t | + | 18.5 | 14,508 |
| *Mont. | 540 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Idaho | 957 | t | + | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | t | + |
| Wyo. | 984 | 1. | 10 | - | - | - | - | - | - | - | - | 0. | 0 | 1. | 10 |
| Colo. | 11,169 | 6 | 721 | t | + | 1. | 120 | 0. | 0 | 0. | 0 | 0. | 0 | 7. | 841 |
| *N. M. | 2,185 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| *Ariz. | 490 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Utah | 525 | 2. | 11 | - | - | - | - | - | - | - | - | 0. | 0 | 2.5 | 14 |
| *Nev. | 52 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| *Wash. | 1,054 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Oreg. | 1,922 | t | + | 0.1 | 2 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 0.2 | 4 |
| *Calif. | 2,178 | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| U. S. | 1,524,317 | 3.4 | 53,009 | 2.7 | 41,953 | 7.6 | 120,350 | 3.3 | 52,885 | 2.5 | 38,885 | t | 166 | 20. | 315,346 |

* Omitted in calculations for U. S. percentage total.

SWEET CORN

Table 6. Sweet corn for manufacture; estimated reduction in yield of sweet corn due to smut (Ustilago zeae), bacterial wilt (Aplanobacter stewarti), stalk and ear rots (Diplodia zeae), and other diseases, 1936.

| State | Production Short Tons | Estimated reduction in yield due to diseases | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Smut | | Bacterial Wilt | | Diplodia | | All Diseases | |
| | | % | Short Tons | % | Short Tons | % | Short Tons | % | Short Tons |
| Maine | 60,800 | t | + | 0. | 0 | t | + | t | + |
| *N. H. | 2,700 | - | - | t | + | - | - | - | - |
| *Vt. | 3,200 | - | - | - | - | - | - | - | - |
| Mass. | | 6. | + | t | + | 2. | + | 17. | + |
| R. I. | | t | + | - | - | - | - | - | - |
| Conn. | | 3. | + | t | + | - | - | 3.5 | + |
| N. Y. | 37,300 | 2. | 761 | t | + | - | - | 2. | 761 |
| N. J. | | - | - | t | + | - | - | - | - |
| Pa. | 21,100 | 6. | 1,407 | t | + | 3. | 703 | 10. | 2,344 |
| Ohio | 37,300 | 1. | 377 | 0.1 | 38 | t | + | 1.1 | 415 |
| Ind. | 39,600 | 5. | 2,084 | t | + | t | + | 5. | 2,084 |
| *Ill. | 117,000 | - | - | - | - | - | - | - | - |
| Mich. | 5,800 | 5. | 306 | 0. | 0 | 0.1 | 6 | 5.2 | 318 |
| Wis. | 25,200 | 5. | 1,400 | t | + | 5. | 1,400 | 10. | 2,800 |
| Minn. | 100,000 | 7. | 7,609 | 0. | 0 | t | + | 8. | 8,696 |
| Iowa | 41,200 | 7. | 3,315 | t | + | 3. | 1,421 | 13. | 6,157 |
| N. D. | | 1. | + | 0. | 0 | - | - | 1.5 | + |
| Kans. | | t | + | 0. | 0 | 0. | 0 | t | + |
| Del. | 10,600 | 0.5 | 54 | - | - | - | - | 1. | 108 |
| Md. | 78,200 | 1. | 833 | 0.1 | 83 | - | - | 6.1 | 5,080 |
| Va. | | 1. | + | 1.5 | + | 0.5 | + | 3.5 | + |
| W. Va. | | 3. | + | 3. | + | 0.5 | + | 14.5 | + |
| Ky. | | - | - | t | + | - | - | - | - |
| *Tenn. | 6,800 | - | - | - | - | - | - | - | - |
| Texas | | 10. | + | 3. | + | 3. | + | 21. | + |
| Idaho | | t | + | 0. | 0 | 0. | 0 | t | + |
| Wyo. | | t | + | 0. | 0 | - | - | - | - |
| Colo. | | 5. | + | 0. | 0 | 0. | 0 | 5. | + |
| Oreg. | | - | - | 0. | 0 | - | - | 0.5 | + |
| **Other States | 18,300 | - | - | - | - | - | - | - | - |
| U. S. | 605,100 | 3.7 | 18,146 | t | 121 | 0.7 | 3,530 | 5.9 | 28,763 |

* Omitted in calculations for U. S. percentage loss.

** Includes Colorado, Idaho, Kansas, Kentucky, Missouri, Montana, Oklahoma, Oregon, South Dakota, Texas, Virginia, Washington, and Wyoming.

SWEET POTATO

Table 7. Estimated reduction in yield of sweet potato due to stem rot (*Fusarium* spp.), foot rot (*Plenodomus destruens*), black rot (*Ceratostomella fimbriata*), and other diseases, and estimated loss from storage rots (various organisms), 1936.

| State | Production | Estimated reduction in yield due to diseases | | | | | | | | Storage Rots | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Stem Rot | | Foot Rot | | Black Rot | | All Diseases | | | |
| | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels |
| Conn. | | t | + | - | - | t | + | - | - | - | - |
| N.J. | 2,400 | 3. | 77 | - | - | 2. | 52 | 7. | 181 | 5. | 120 |
| Pa. | | t | + | 1.5 | + | t | + | 1.5 | + | 2. | + |
| *Ind. | 320 | t | + | - | - | - | - | - | - | - | - * |
| *Ill. | 300 | - | - | - | - | - | - | - | - | - | - * |
| Iowa | 225 | 30. | 97 | 0. | 0 | 0. | 0 | 30.3 | 98 | - | - * |
| *Mo. | 754 | - | - | - | - | - | - | - | - | - | - * |
| Kans. | 240 | 6. | 15 | - | - | t | + | 7. | 18 | 4. | 10 |
| Del. | 910 | 1. | 9 | - | - | 0.5 | 5 | 3.5 | 33 | 8. | 73 |
| Md. | 1,200 | 2. | 26 | t | + | 2. | 26 | 8. | 104 | 8. | 96 |
| Va. | 4,366 | 7. | 336 | t | + | 2. | 96 | 9. | 432 | 10. | 437 |
| N.C. | 7,560 | 15. | 1,418 | - | - | t | + | 20. | 1,891 | 15. | 1,134 |
| S.C. | 4,845 | - | - | - | - | 2. | 102 | 5. | 255 | - | - * |
| Ga. | 6,630 | - | - | - | - | 2. | 135 | 2. | 135 | 10. | 663 |
| *Fla. | 1,235 | - | - | - | - | - | - | - | - | - | - * |
| Ky. | 1,342 | 15. | 246 | - | - | 3. | 49 | 18. | 295 | 2. | 268 |
| *Tenn. | 3,696 | - | - | - | - | - | - | - | - | - | - * |
| Ala. | 6,160 | - | - | - | - | 2. | 126 | 2. | 126 | 10. | 616 |
| *Miss. | 6,474 | t | + | - | - | - | - | - | - | 10. | 647 |
| Ark. | 2,145 | 2. | 45 | - | - | 2. | 45 | 4. | 90 | 10. | 215 |
| La. | 7,797 | t | + | - | - | 2. | 161 | 3. | 241 | - | - * |
| Okla. | 525 | 2. | 11 | 3. | 17 | 1. | 6 | 8. | 45 | 20. | 105 |
| Texas | 3,640 | 1. | 46 | 0. | 0 | 10. | 461 | 21. | 968 | 12. | 437 |
| *Calif. | 1,380 | - | - | - | - | - | - | - | - | - | - * |
| U.S. | 64,144 | 4.2 | 2,326 | t | 17 | 2.3 | 1,264 | 8.9 | 4,912 | 11.1 | 4,821 |

* Omitted in calculations for U. S. percentage loss.

Table 8. Estimated reduction in yield of potato due to mosaic (virus), leaf roll (virus), late blight (*Phytophthora infestans*), Rhizoctonia (*Corticium vagum*).

| State | Production: 1,000 Bushels | Estimated reduction in yield due to diseases | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mosaic | | Leaf Roll | | Late Blight | | Rhizoctonia | |
| | | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels |
| Maine | 44,000 | 2. | 1,048 | 1. | 524 | 6. | 3,143 | 2. | 1,048 |
| N. H. | 1,666 | 5. | 94 | 2. | 37 | 1. | 19 | 1. | 19 |
| Vt. | 2,392 | 3. | 111 | 5. | 185 | 7. | 259 | 7. | 259 |
| Mass. | 2,415 | 3. | 93 | 3. | 93 | 3. | 93 | 8. | 248 |
| *R. I. | 720 | - | - | - | - | - | - | - | - |
| Conn. | 2,839 | 1. | 30 | - | - | - | - | 0.5 | 15 |
| *N. Y. | 26,400 | - | - | - | - | - | - | - | - |
| *N. J. | 9,130 | - | - | - | - | - | - | - | - |
| Pa. | 26,268 | 3. | 983 | 5. | 1,638 | t | + | 2. | 655 |
| Ohio | 14,040 | 0.5 | 86 | 5. | 861 | t | + | 2. | 345 |
| Ind. | 4,617 | 3. | 153 | 2. | 102 | - | - | 0.5 | 26 |
| *Ill. | 2,666 | - | - | - | - | - | - | - | - |
| Mich. | 26,125 | 0.2 | 64 | 1. | 319 | t | + | 5. | 1,593 |
| Wis. | 20,090 | t | + | 0. | 0 | 0. | 0 | t | + |
| Minn. | 12,502 | 5. | 781 | - | - | 0. | 0 | 3. | 469 |
| Iowa | 3,551 | 8. | 379 | 7. | 331 | 0. | 0 | 3. | 142 |
| *Mo. | 2,860 | - | - | - | - | - | - | - | - |
| N. D. | 5,170 | 1. | 55 | 1. | 55 | 0. | 0 | 1. | 55 |
| S. D. | 783 | 1. | 11 | 1. | 11 | 0. | 0 | 2. | 23 |
| *Nebr. | 4,730 | - | - | - | - | - | - | - | - |
| Kans. | 1,710 | t | + | - | - | - | - | 5. | 93 |
| Del. | 475 | 0.5 | 2 | 0.5 | 2 | - | - | t | + |
| Md. | 2,940 | 1.5 | 51 | 2. | 68 | 0.5 | 17 | 2. | 68 |
| Va. | 7,380 | 2. | 178 | 2. | 178 | 0. | 0 | 1. | 89 |
| W. Va. | 1,920 | 4. | 128 | 12. | 384 | t | + | 4. | 128 |
| N. C. | 5,986 | 1. | 68 | 2. | 136 | t | + | 3. | 204 |
| *S. C. | 1,656 | - | - | - | - | - | - | - | - |
| Ga. | 768 | 1. | 9 | 0.1 | 1 | 0.1 | 1 | 2. | 17 |
| Fla. | 2,349 | 1. | 26 | - | - | 4. | 105 | 2. | 53 |
| Ky. | 1,692 | t | + | t | + | 0. | 0 | 5. | 91 |
| *Tenn. | 1,480 | - | - | - | - | - | - | - | - |
| *Ala. | 2,784 | - | - | - | - | - | - | - | - |
| *Miss. | 1,088 | - | - | - | - | - | - | - | - |
| *Ark. | 2,365 | - | - | - | - | - | - | - | - |
| La. | 2,652 | 3. | 83 | - | - | - | - | - | - |
| Okla. | 2,112 | - | - | - | - | 0. | 0 | 0. | 0 |
| Texas | 2,860 | 2. | 77 | 1. | 38 | t | + | 1. | 38 |
| Mont. | 1,520 | 4. | 69 | 0. | 0 | 0. | 0 | 2. | 35 |
| Idaho | 22,260 | 4. | 937 | t | + | 0. | 0 | t | + |
| Wyo. | 1,365 | 2. | 32 | t | + | t | + | 3. | 48 |
| Colo. | 18,500 | t | + | 0. | 0 | 0. | 0 | 1. | 193 |
| *N. M. | 450 | - | - | - | - | - | - | - | - |
| *Ariz. | 180 | - | - | - | - | - | - | - | - |
| Utah | 1,830 | 3. | 68 | 2. | 45 | 0. | 0 | 8. | 182 |
| *Nev. | 406 | - | - | - | - | - | - | - | - |
| *Wash. | 8,010 | - | - | - | - | - | - | - | - |
| Oreg. | 7,310 | 5. | 440 | 7. | 616 | t | + | 5. | 440 |
| *Calif. | 12,985 | - | - | - | - | - | - | - | - |
| U. S. | 329,997 | 2. | 6,056 | 1.9 | 5,624 | 1.2 | 3,637 | 2.2 | 6,576 |

* Omitted in calculations for U. S. percentage loss.

POTATO (Continued)

Blackleg (Bacillus phytophthorus), Fusarium wilt (Fusarium spp.), tipburn and hopperburn (non-parasitic and leaf hopper), early blight (Alternaria solani), scab (Actinomyces scabies), and other diseases, 1936.

| State | Estimated reduction in yield due to diseases | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Blackleg | | Fusarium Wilt | | Tipburn and Hopperburn | | Early Blight | | Scab | | All Diseases | |
| | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels |
| Maine | 2. | 1,048 | - | - | 1. | 524 | 1. | 524 | 1. | 524 | 16. | 8,383 |
| N.H. | 1. | 19 | - | - | - | - | t | + | 1. | 19 | 11. | 207 |
| Vt. | 0.2 | 7 | 0.1 | 4 | 10. | 370 | 1.5 | 55 | 1.5 | 55 | 35.3 | 1,305 |
| Mass. | t | + | - | - | 3. | 93 | 0.5 | 15 | 0.5 | 15 | 22. | 681 |
| R.I. | - | - | - | - | - | - | - | - | - | - | - | - |
| Conn. | 1. | 30 | 0.5 | 15 | 1. | 30 | - | - | 1. | 30 | 5. | 150 |
| N.Y. | - | - | - | - | - | - | - | - | - | - | - | - |
| N.J. | - | - | - | - | - | - | - | - | - | - | - | - |
| Pa. | t | + | 2. | 655 | 2. | 655 | 0.5 | 164 | 0.3 | 98 | 19.8 | 6,486 |
| Ohio | 0.5 | 86 | 2. | 345 | 6. | 1,034 | 1. | 172 | 1.5 | 258 | 18.5 | 3,187 |
| Ind. | - | - | - | - | - | - | - | - | 4. | 204 | 9.5 | 485 |
| Ill. | - | - | - | - | - | - | - | - | - | - | - | - |
| Mich. | 2.5 | 797 | 1. | 319 | 5. | 1,593 | 0.2 | 64 | 2.5 | 797 | 18. | 5,737 |
| Wis. | t | + | t | + | 10. | 2,511 | 5. | 1,256 | 4. | 1,005 | 20. | 5,023 |
| Minn. | t | + | 4. | 625 | 5. | 781 | t | + | 2. | 313 | 20. | 3,125 |
| Iowa | 0. | 0 | 1. | 47 | 5. | 237 | 0.5 | 24 | 0.5 | 24 | 25. | 1,184 |
| Mo. | - | - | - | - | - | - | - | - | - | - | - | - |
| N.D. | 1. | 55 | 1.5 | 83 | 0.5 | 28 | 0. | 0 | t | + | 6. | 331 |
| S.D. | t | + | 10. | 114 | 10. | 114 | 0. | 0 | 2. | 23 | 31. | 353 |
| Nebr. | - | - | - | - | - | - | - | - | - | - | - | - |
| Kans. | 0.5 | 9 | t | + | - | - | - | - | 0.5 | 9 | 8. | 148 |
| Del. | - | - | t | + | 0.5 | 2 | 0.5 | 2 | t | + | 2. | 8 |
| Md. | t | + | 1.5 | 51 | 1. | 34 | 1. | 34 | 4. | 136 | 13.5 | 459 |
| Va. | 1. | 89 | - | - | 2. | 178 | t | + | 7. | 622 | 17. | 1,512 |
| W.Va. | 3. | 96 | 1. | 32 | 8. | 256 | t | + | 0.5 | 16 | 40. | 1,280 |
| N.C. | t | + | 1. | 68 | 3. | 204 | 1. | 68 | 1. | 68 | 12. | 816 |
| S.C. | - | - | - | - | - | - | - | - | - | - | - | - |
| Ga. | 2. | 17 | - | - | 1. | 9 | 5. | 43 | 0.1 | 1 | 11.3 | 98 |
| Fla. | 1. | 26 | 0.5 | 13 | - | - | t | + | 0.5 | 13 | 10.5 | 275 |
| Ky. | t | + | t | + | 1. | 18 | t | + | 0.5 | 9 | 7. | 127 |
| Tenn. | - | - | - | - | - | - | - | - | - | - | - | - |
| Ala. | - | - | - | - | - | - | - | - | - | - | - | - |
| Miss. | - | - | - | - | - | - | - | - | - | - | - | - |
| Ark. | t | + | - | - | - | - | - | - | - | - | - | - |
| La. | - | - | t | + | - | - | t | + | t | + | 4. | 111 |
| Okla. | 3. | 71 | 5. | 119 | - | - | 1. | 24 | 2. | 47 | 11. | 261 |
| Texas | 0.1 | 4 | 0.1 | 4 | 0.5 | 19 | 5. | 192 | 10. | 385 | 25.7 | 988 |
| Mont. | t | + | 2. | 35 | t | + | t | + | 2. | 35 | 12. | 209 |
| Idaho | 1. | 234 | t | + | 0. | 0 | t | + | t | + | 5. | 1,171 |
| Wyo. | 2. | 32 | 4. | 63 | - | - | t | + | - | - | 14. | 223 |
| Colo. | t | + | 1. | 193 | 0. | 0 | 2. | 385 | t | + | 4. | 771 |
| N.M. | - | - | - | - | - | - | - | - | - | - | - | - |
| Ariz. | - | - | - | - | - | - | - | - | - | - | - | - |
| Utah | t | + | 1. | 23 | - | - | t | + | 0.5 | 11 | 19.5 | 443 |
| Nev. | - | - | - | - | - | - | - | - | - | - | - | - |
| Wash. | - | - | - | - | - | - | - | - | - | - | - | - |
| Oreg. | t | + | - | - | - | - | t | + | - | - | 17. | 1,496 |
| Calif. | - | - | - | - | - | - | - | - | - | - | - | - |
| U.S. | 0.9 | 2,620 | 0.9 | 2,808 | 2.9 | 8,690 | 1. | 3,022 | 1.6 | 4,717 | 15.7 | 47,033 |

Table 9. Tomatoes for manufacture; estimated reduction in yield due to blight (Septoria lycopersici), Fusarium wilt (Fusarium lycopersisi), early blight (Alternaria solani), nailhead spot (Macrosporium tomato), blossom-end rot (non-parasitic), curly-top (virus), and other diseases, 1936.

| State | Production Short Tons° | Septoria Blight % | Septoria Blight Short Tons | Fusarium Wilt % | Fusarium Wilt Short Tons | Bacterial Wilt % | Bacterial Wilt Short Tons | Early Blight % | Early Blight Short Tons | Nailhead Spot % | Nailhead Spot Short Tons | Blossom-end Rot % | Blossom-end Rot Short Tons | Curly-top % | Curly-top Short Tons | All Diseases % | All Diseases Short Tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conn. | | 1. | + | 0.5 | + | - | - | 1. | + | - | - | - | - | 0. | 0 | 4.5 | + |
| *N.Y. | 121,400 | t | + | - | - | - | - | t | + | - | - | - | - | 0. | 0 | - | - |
| *N.J. | 244,200 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Pa. | 93,200 | 1. | 1,277 | 2. | 2,553 | 1. | 1,277 | 8. | 10,214 | - | - | 12. | 15,321 | 0. | 0 | 27. | 34,472 |
| Ohio | 78,800 | t | + | 3. | 2,612 | 0.5 | 435 | 1. | 871 | 0.5 | 435 | 2. | 1,741 | 0. | 0 | 9.5 | 8,271 |
| Ind. | 373,600 | - | - | 1.5 | 5,994 | - | - | 4. | 15,983 | - | - | - | - | 0. | 0 | 6.5 | 25,973 |
| Ill. | 27,800 | t | + | 1. | 302 | t | + | 2. | 604 | - | - | - | - | 0. | 0 | 8. | 2,417 |
| Mich. | 28,200 | 3. | 951 | t | + | 0. | 0 | t | + | - | - | 5. | 1,584 | 0. | 0 | 11. | 3,486 |
| Wis. | | 10. | + | t | + | 0. | 0 | 10. | + | t | + | 2. | + | 0. | 0 | 23.5 | + |
| Minn. | | t | + | t | + | 0. | 0 | t | + | 0. | 0 | 3. | + | 0. | 0 | 4. | + |
| Iowa | 9,200 | 1. | 103 | t | + | 0. | 0 | 0. | 0 | 0. | 0 | 8. | 827 | 0. | 0 | 11. | 1,137 |
| *Mo. | 1,100 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Kans. | | - | - | 1. | + | - | - | - | - | - | - | - | - | 0. | 0 | 1. | + |
| Del. | 61,100 | 1. | 633 | 0.5 | 317 | - | - | t | + | - | - | t | + | 0. | 0 | 3.5 | 2,216 |
| Md. | 297,000 | 0.1 | 386 | 1. | 3,857 | t | + | 5.2 | 20,057 | - | - | 5. | 19,286 | 0. | 0 | 23. | 88,715 |
| Va. | 55,400 | 1. | 68 | 10. | 684 | 3. | 205 | 2. | 137 | 0. | 0 | 0. | 0 | 0. | 0 | 19. | 1,299 |
| W.Va. | | 1. | + | 2. | + | - | - | t | + | - | - | 3. | + | 0. | 0 | 9. | + |
| N.C. | | 3. | + | 3. | + | 5. | + | - | - | 2. | + | 5. | + | 0. | 0 | 23. | + |
| Ga. | | 0.1 | + | 7. | + | 0.1 | + | 5. | + | 0.1 | + | 30. | + | 0. | 0 | 47.3 | + |
| Fla. | | - | - | 2. | + | t | + | 3. | + | 1.5 | + | - | - | 0. | 0 | 8.5 | + |
| Ky. | 5,700 | t | + | 3. | 211 | 0. | 0 | 0. | 0 | t | + | 15. | 1,056 | 0. | 0 | 19. | 1,337 |
| *Tenn. | 10,100 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Miss. | | - | - | 1. | + | 1. | + | 1. | + | - | - | 20. | + | 0. | 0 | 33. | + |
| Ark. | 2,300 | t | + | t | + | - | - | t | + | - | - | 2. | 47 | 0. | 0 | 2. | 47 |
| La. | | t | + | 3. | + | t | + | 2. | + | - | - | t | + | 0. | 0 | 6. | + |

Tomatoes (Continued)

| State | Production Short Tons° | Septoria Blight % | Septoria Blight Short Tons | Fusarium Wilt % | Fusarium Wilt Short Tons | Bacterial Wilt % | Bacterial Wilt Short Tons | Early Blight % | Early Blight Short Tons | Nailhead Spot % | Nailhead Spot Short Tons | Blossom-end Rot % | Blossom-end Rot Short Tons | Curly-top % | Curly-top Short Tons | All Diseases % | All Diseases Short Tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Okla. | | 3. | + | 20. | + | 2. | + | 1. | + | 0.5 | + | 3. | + | 0. | 0 | 29.5 | + |
| Texas | | 3. | + | 5. | + | 0.5 | + | 2. | + | 0. | 0 | 5. | + | 0.5 | + | 16. | + |
| Idaho | | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 2. | + | 25. | + | 27. | + |
| Colo. | 22,700 | t | + | t | + | 0. | 0 | 2. | 522 | 0. | 0 | 1. | 261 | 3. | 783 | 13. | 3,392 |
| Utah | 58,500 | - | - | t | + | - | - | - | - | - | - | t | + | 12. | 8,561 | 18. | 12,841 |
| Oreg. | | - | - | - | - | - | - | - | - | - | - | - | - | 20. | + | 20. | + |
| *Calif. | 418,700 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Other States | 66,900 | | | | | | | | | | | | | | | | |
| U. S. | 1,975,900 | 0.3 | 3,418 | 1.2 | 16,530 | 0.1 | 1,917 | 3.5 | 48,388 | t | 435 | 2.9 | 40,123 | 0.7 | 9,344 | 13.5 | 185,603 |

° Short tons, 2,000 pounds.

* Omitted in calculations for U. S. percentage loss.

** Includes Alabama, Connecticut, Florida, Georgia, Idaho, Kansas, Louisiana, Minnesota, Mississippi, Nebraska, New Mexico, North Carolina, Oklahoma, Oregon, South Carolina, Texas, Washington, West Virginia, and Wisconsin.

Table 10. Tomatoes for market; estimated reduction in yield due to blight (Septoria lycopersici), Fusarium wilt (Fusarium lycopersici), early blight (Alternaria solani), nailhead spot (Macrosporium tomato), blossom-end rot (non-parasitic), curly-top (virus), and other diseases, 1936.

| State | Production 1,000 °Bushels | Septoria Blight % | Septoria Blight 1,000 Bushels | Fusarium Wilt % | Fusarium Wilt 1,000 Bushels | Bacterial Wilt % | Bacterial Wilt 1,000 Bushels | Early Blight % | Early Blight 1,000 Bushels | Nailhead Spot % | Nailhead Spot 1,000 Bushels | Blossom-end Rot % | Blossom-end Rot 1,000 Bushels | Curly-top % | Curly-top 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maine |  | t | + | - | - | - | - | t | + | - | - | t | + | 0. | 0 | t | + |
| Mass. |  | 1. | + | t | + | 0. | 0 | 7. | + | - | - | 2. | + | 0. | 0 | 14. | + |
| R.I. |  | t | + | - | - | - | - | 10. | + | 1. | + | - | - | 0. | 0 | 12. | + |
| Conn. |  | 1. | + | 0.5 | + | - | - | 1. | + | - | - | 0.1 | + | 0. | 0 | 3.6 | + |
| *N.Y. | 1,332 | t | + | - | - | - | - | t | + | - | - | - | - | 0. | 0 | - | - |
| *N.J. | 2,310 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Pa. | 430 | 1. | 6 | 2. | 12 | 1. | 6 | 8. | 47 | - | - | 12. | 71 | 0. | 0 | 27. | 160 |
| Ohio | 352 | t | + | 3. | 12 | 0.5 | 2 | 1. | 4 | 0.5 | 2 | 2. | 8 | 0. | 0 | 9.5 | 38 |
| Ind. | 560 | - | - | 1.5 | 9 | - | - | 4. | 24 | - | - | - | - | 0. | 0 | 6.5 | 39 |
| Ill. | 52 | t | + | 1. | 1 | t | + | 2. | 1 | - | - | - | - | 0. | 0 | 8. | 5 |
| Mich. | 480 | 3. | 16 | t | + | 0. | 0 | t | + | - | - | 5. | 27 | 0. | 0 | 11. | 59 |
| Wis. |  | 10. | + | t | + | 0. | 0 | 10. | + | t | + | 2. | + | 0. | 0 | 23.5 | + |
| Minn. |  | t | + | t | + | 0. | 0 | t | + | 0. | 0 | 3. | + | 0. | 0 | 4. | + |
| Iowa | 35 | 1. | + | t | + | 0. | 0 | 0. | 0 | 0. | 0 | 8. | 3 | 0. | 0 | 11. | 4 |
| *Mo. | 200 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| N.D. |  | t | + | t | + | t | + | t | + | 0. | 0 | 2. | + | 0. | 0 | 3. | + |
| Kans. |  | - | - | 1. | + | - | - | - | - | - | - | - | - | 0. | 0 | 1. | + |
| Del. | 25 | 1. | + | 0.5 | + | - | - | t | + | - | - | t | + | 0. | 0 | 3.5 | 1 |
| Md. | 1,160 | 0.1 | 2 | 1. | 15 | t | + | 5.2 | 78 | - | - | 5. | 75 | 0. | 0 | 23. | 346 |
| Va. | 420 | 1. | 5 | 10. | 52 | 3. | 16 | 2. | 10 | 0. | 0 | 0. | 0 | 0. | 0 | 19. | 99 |
| W.Va. |  | 1. | + | 2. | + | - | - | t | + | - | - | 3. | + | 0. | 0 | 9. | + |
| N.C. | 69 | 3. | 3 | 3. | 3 | 5. | 5 | - | - | 2. | 2 | 5. | 5 | 0. | 0 | 23. | 23 |
| *S.C. | 315 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Ga. | 105 | 0.1 | + | 7. | 14 | 0.1 | + | 5. | 10 | 0.1 | + | 30. | 60 | 0. | 0 | 47.3 | 94 |
| Fla. | 2,470 | - | - | 2. | 54 | t | + | 3. | 81 | 1.5 | 40 | - | - | 0. | 0 | 8.5 | 229 |

Tomatoes (Continued)

| State | Production 1,000 °Bushels | Septoria Blight % | Septoria Blight 1,000 Bushels | Fusarium Wilt % | Fusarium Wilt 1,000 Bushels | Bacterial Wilt % | Bacterial Wilt 1,000 Bushels | Early Blight % | Early Blight 1,000 Bushels | Nailhead Spot % | Nailhead Spot 1,000 Bushels | Blossom-end Rot % | Blossom-end Rot 1,000 Bushels | Curly-top % | Curly-top 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimated reduction in yield due to diseases | | | | | | | | | | | | | | | |
| Ky. | 162 | t | + | 3. | 6 | 0. | 0 | 0. | 0 | t | + | 15. | 30 | 0. | 0 | 19. | 38 |
| *Tenn. | 693 | - | - | - | - | - | - | - | - | - | - | - | - | 0. | 0 | - | - |
| Miss. | 1,009 | - | - | 1. | 15 | 1. | 15 | 1. | 15 | - | - | 20. | 301 | 0. | 0 | 33. | 497 |
| Ark. | 1[illegible] | t | + | t | + | - | - | t | + | - | - | 2. | 3 | 0. | 0 | 2. | 3 |
| La. | 132 | t | + | 3. | 4 | t | + | 2. | 3 | - | - | t | + | 0. | 0 | 6. | 8 |
| Okla. | | 3. | + | 20. | + | 2. | + | 1. | + | 0.5 | + | 3. | + | 0. | 0 | 29.5 | + |
| Texas | 3,075 | 3. | 110 | 5. | 183 | 0.5 | 18 | 2. | 73 | 0. | 0 | 5. | 183 | 0.5 | 18 | 16. | 585 |
| Mont. | | 0. | 0 | t | + | 0. | 0 | 0. | 0 | 0. | 0 | t | + | t | + | 3. | + |
| Idaho | | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 2. | + | 25. | + | 27. | + |
| Colo. | 475 | t | + | t | + | 0. | 0 | 2. | 11 | 0. | 0 | 1. | 5 | 3. | 16 | 13. | 70 |
| Utah | 88 | - | - | t | + | - | - | - | - | - | - | t | + | 12. | 13 | 18. | 19 |
| *Wash. | 384 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 225 | - | - | - | - | - | - | - | - | - | - | - | - | 20. | 55 | 20. | 55 |
| *Calif. | 3,614 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| U. S. | 20,346 | 1. | 142 | 2.7 | 380 | 0.4 | 62 | 2.6 | 357 | 0.3 | 44 | 5.6 | 771 | 0.7 | 102 | 17. | 2,372 |

° Bushels of 53 pounds.
* Omitted in calculations for U. S. percentage loss.

Table 11. Snap beans for manufacture; estimated reduction in yield due to anthracnose (Colletotrichum lindemuthianum), bacterial blights (Bacterium spp.), mosaic (virus), root rots (various organisms), rust (Uromyces phaseoli typica), and other diseases, 1936.

| State | Production Short Tons | Anthracnose % | Anthracnose Short Tons | Bacterial Blights % | Bacterial Blights Short Tons | Mosaic % | Mosaic Short Tons | Root Rots % | Root Rots Short Tons | Rust % | Rust Short Tons | All Diseases % | All Diseases Short Tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maine | 2,900 | t | + | t | + | - | - | t | + | t | + | t | + |
| N.H. | | t | + | - | - | - | - | - | - | t | + | t | + |
| N.Y. | 10,400 | t | + | 0.5 | 54 | 1.5 | 162 | 1.5 | 162 | t | + | 3.5 | 378 |
| N.J. | | - | - | - | - | - | - | - | - | 1. | + | 1. | + |
| Pa. | 2,200 | 4. | 104 | 0.5 | 13 | 4. | 104 | 5. | 130 | 1. | 26 | 15.5 | 403 |
| Ohio | | 1. | + | 0.5 | + | 1. | + | 0.5 | + | t. | + | 3. | + |
| Ind. | 1,100 | - | - | 1. | 11 | - | - | - | - | - | - | 1. | 11 |
| Ill. | | 0.3 | + | 0.3 | + | 10. | + | 1. | + | - | - | 11.6 | + |
| Mich. | 6,500 | 0. | 0 | 2.5 | 167 | 0. | 0 | 0.1 | 7 | 0. | 0 | 2.7 | 181 |
| Wis. | 5,000 | 0. | 0 | 1. | 53 | 5. | 266 | t | + | 0. | 0 | 6. | 319 |
| Minn. | | t | + | 2. | + | 3. | + | t | + | 0. | 0 | 6. | + |
| Iowa | | t | + | 2. | + | 0. | 0 | 0. | 0 | 0. | 0 | 3. | + |
| Del. | 1,100 | t | + | - | - | - | - | t | + | - | - | t | + |
| Md. | 13,500 | t | + | 1. | 141 | 0.5 | 70 | 2.5 | 352 | - | - | 4.1 | 577 |
| Va. | | 0. | 0 | 3. | + | 2. | + | 3. | + | 10. | + | 28. | + |
| N.C. | | t | + | 2. | + | 2. | + | 9. | + | 1. | + | 22. | + |
| *S.C. | 100 | - | - | - | - | - | - | - | - | - | - | - | - |
| Ga. | | 1. | + | - | - | - | - | - | - | 2. | + | 3. | + |
| Fla. | | t | + | t | + | - | - | t | + | 5. | + | 5. | + |
| Ky. | | 0. | 0 | t | + | 3. | + | t | + | t | + | 4. | + |
| *Tenn. | 1,200 | - | - | - | - | - | - | - | - | - | - | - | - |
| Miss. | 1,800 | t | + | 1. | 19 | 1. | 19 | - | - | - | - | 4. | 76 |
| *Ark. | 400 | - | - | - | - | - | - | - | - | - | - | - | - |
| La. | 700 | t | + | 4. | 30 | - | - | 2. | 15 | t | + | 6. | 45 |
| Okla. | | - | - | 50. | + | 10. | + | 8. | + | - | - | 78. | + |
| Texas | | t | + | 5. | + | 8. | + | 6. | + | t | + | 24. | + |
| Mont. | | 0. | 0 | 1. | + | 5. | + | 1. | + | 0. | 0 | 7. | + |
| Idaho | | 0. | 0 | t | + | 10. | + | 5. | + | 0. | 0 | 25. | + |
| Colo. | 1,400 | 0. | 0 | 20. | 354 | t | + | t | + | 1. | 18 | 21. | 372 |
| Utah | 2,000 | - | - | t | + | 2. | 41 | t | + | 0.5 | 10 | 2.5 | 51 |
| *Wash. | 2,800 | - | - | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 7,600 | - | - | - | - | - | - | - | - | - | - | 5. | 400 |
| Calif. | 3,700 | - | - | - | - | - | - | - | - | 1. | 37 | 1. | 37 |
| +Other States | 6,200 | | | | | | | | | | | | |
| U.S. | 70,600 | 0.2 | 104 | 1.3 | 842 | 1.1 | 662 | 1.1 | 666 | 0.1 | 91 | 4.6 | 2,850 |

* Omitted in calculations for U. S. percentage loss.

\+ Includes Alabama, Georgia, Florida, Idaho, Illinois, Iowa, Kansas, Kentucky, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, North Carolina, Ohio, Oklahoma, Texas, Vermont, Virginia, West Virginia, and Wyoming.

Table 12. Snap beans for market; estimated reduction in yield due to Anthracnose (Colletotrichum lindemuthianum), bacterial blights (Bacterium spp.), mosaic (virus), root rots (various organisms), rust (Uromyces phaseoli typica), and other diseases, 1936.

| State | Production 1,000 Bushels[a] | Anthracnose % | Anthracnose 1,000 Bushels | Bacterial Blights % | Bacterial Blights 1,000 Bushels | Mosaic % | Mosaic 1,000 Bushels | Root Rots % | Root Rots 1,000 Bushels | Rust % | Rust 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maine | | t | + | t | + | - | - | t | + | t | + | t | + |
| N.H. | | t | + | - | - | - | - | - | - | t | + | t | + |
| Mass. | | 0.5 | + | 3. | + | 2. | + | 6. | + | t | + | 11.5 | + |
| Conn. | | t | + | t | + | t | + | - | - | 0.5 | + | 1. | + |
| N.Y. | 232 | t | + | 0.5 | 1 | 1.5 | 4 | 1.5 | 4 | t | + | 3.5 | 9 |
| N.J. | 1,341 | - | - | - | - | - | - | - | - | 1. | 14 | 1. | 14 |
| ?a. | 284 | 4. | 13 | 0.5 | 2 | 4. | 13 | 5. | 17 | 1. | 3 | 15.5 | 51 |
| )hio | | 1. | + | 0.5 | + | 1. | + | 0.5 | + | t | + | 3. | + |
| [nd. | | - | - | 1. | + | - | - | - | - | - | - | 1. | + |
| [ll. | 54 | 0.3 | + | 0.3 | + | 10. | 6 | 1. | 1 | - | - | 11.6 | 7 |
| ich. | 51 | 0. | 0 | 2.5 | 1 | 0. | 0 | 0.1 | + | 0. | 0 | 2.7 | 1 |
| is. | | 0. | 0 | 1. | + | 5. | + | t | + | 0. | 0 | 6. | + |
| inn. | | t | + | 2. | + | 3. | + | t | + | 0. | 0 | 6. | + |
| owa | | t | + | 2. | + | 0. | 0 | 0. | 0 | 0. | 0 | 3. | + |
| .D. | | t | + | 0.5 | + | 2.5 | + | t | + | 0. | 0 | 3. | + |
| el. | 18 | t | + | - | - | - | - | t | + | - | - | t | + |
| d. | 322 | t | + | 1. | 3 | 0.5 | 2 | 2.5 | 8 | - | - | 4.1 | 13 |
| a. | 617 | 0. | 0 | 3. | 26 | 2. | 17 | 3. | 26 | 10. | 86 | 28. | 241 |
| .Va. | | 1. | + | 5. | + | 2. | + | 2. | + | t | + | 10. | + |
| .C. | 369 | t | + | 2. | 10 | 2. | 10 | 9. | 43 | - | - | 23. | 111 |
| .C. | 190 | - | - | - | - | - | - | - | - | - | - | - | - |
| a. | 202 | 1. | 2 | - | - | - | - | - | - | 2. | 4 | 3. | 6 |
| la. | 4,300 | t | + | 10. | 694 | - | - | 1. | 69 | 22. | 1,526 | 38. | 2,636 |
| y. | | 0. | 0 | t | + | 3. | + | t | + | t | + | 4. | + |
| enn. | 49 | - | - | - | - | - | - | - | - | - | - | - | - |
| la. | 25 | - | - | - | - | - | - | - | - | - | - | - | - |
| iss. | 430 | t | + | 1. | 4 | 1. | 4 | - | - | - | - | 4. | 17 |
| rk. | 71 | - | - | - | - | - | - | - | - | - | - | - | - |
| a. | 756 | t | + | 4. | 32 | - | - | 2. | 16 | t | + | 6. | 48 |
| la. | | - | - | 50. | + | 10. | + | 8. | + | - | - | 78. | + |
| exas | 538 | t | + | 5. | 35 | 8. | 57 | 6. | 42 | t | + | 24. | 169 |
| nt. | | 0. | 0 | 1. | + | 5. | + | 1. | + | 0. | 0 | 7. | + |
| aho | | 0. | 0 | t | + | 10. | + | 5. | + | 0. | 0 | 25. | + |
| o. | | 0. | 0 | 5. | + | 5. | + | 4. | + | - | - | 14. | + |
| lo. | 300 | 0. | 0 | 20. | 76 | t | + | t | + | 1. | 4 | 21. | 80 |
| M. | | 0. | 0 | - | - | - | - | - | - | 1. | + | 1. | + |
| ah | | 0. | 0 | t | + | 2. | + | t | + | - | - | 2.5 | + |
| eg. | | 0. | 0 | - | - | - | - | - | - | - | - | 5. | + |
| lif | 1,870 | 0. | 0 | - | - | - | - | - | - | 1. | 19 | 1. | 19 |
| S. | 12,019 | 0.1 | 15 | 5.9 | 884 | 0.7 | 113 | 1.5 | 226 | 11. | 1,656 | 22.7 | 3,422 |

[a] Bushels of 30 pounds.

[b] Omitted in calculations for U. S. percentage loss.

Table 13. Estimated reduction in yield of dry beans due to anthracnose (Colletotrichum lindemuthianum), bacterial blights (Bacterium spp.), mosaic (virus), root rots (various organisms), rust (Uromyces phaseoli typica), and other diseases, 1936.

| State | Production 1,000 °Bags | Anthracnose % | Anthracnose 1,000 Bags | Bacterial Blight % | Bacterial Blight 1,000 Bags | Mosaic % | Mosaic 1,000 Bags | Root Rots % | Root Rots 1,000 Bags | Rust % | Rust 1,000 Bags | All Diseases % | All Diseases 1,000 Bags |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maine | 70 | t | + | t | + | t | + | t | + | t | + | t | + |
| *Vt. | 18 | - | - | - | - | - | - | - | - | - | - | - | - |
| N.Y. | 852 | t | + | 0.5 | 4 | 1.5 | 13 | 1.5 | 13 | t | + | 3.5 | 30 |
| Mich. | 2,656 | 0. | 0 | 2.5 | 68 | 0. | 0 | 0.1 | .3 | 0. | 0 | 2.7 | 74 |
| Wis. | 12 | 0. | 0 | 1. | + | 5. | 1 | t | + | 0. | 0 | 6. | 1 |
| Minn. | 6 | t | + | 2. | + | 3. | + | t | + | 0. | 0 | 6. | + |
| *Nebr. | 113 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Kans. | 7 | - | - | - | - | - | - | - | - | - | - | - | - |
| Mont. | 168 | 0. | 0 | 1. | 2 | 5. | 9 | 1. | 2 | 0. | 0 | 7. | 13 |
| Idaho | 1,248 | 0. | 0 | t | + | 10. | 166 | 5. | 83 | 0. | 0 | 25. | 415 |
| Wyo. | 460 | 0. | 0 | 5. | 27 | 5. | 27 | 4. | 21 | - | - | 14. | 75 |
| Colo. | 1,091 | 0. | 0 | 20. | 276 | t | + | t | + | 1. | 14 | 21. | 290 |
| N.M. | 288 | 0. | 0 | - | - | - | - | - | - | 1. | 3 | 1. | 3 |
| *Ariz. | 46 | 0. | 0 | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 6 | 0. | 0 | - | - | - | - | - | - | - | - | 5. | + |
| Calif | 4,081 | 0. | 0 | - | - | - | - | - | - | 1. | 41 | 1. | 41 |
| U. S. | 11,122 | t | + | 3.2 | 377 | 1.8 | 216 | 1. | 122 | 0.5 | 58 | 7.9 | 942 |

° Bags of 100 pounds.
* Omitted in calculations for U. S. percentage loss.

GREEN PEAS

Table 14. Green peas for manufacture; estimated reduction in yield due to bacterial blight (Bacterium pisi), Fusarium wilt (Fusarium orthoceras pisi), Ascochyta blight (Mycosphaerella pinodes and Ascochyta spp.), root rots (various organisms), and other diseases, 1936.

| State | Production Short Tons | Estimated reduction in yield due to diseases | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bacterial Blight | | Fusarium Wilt | | Ascochyta Blight | | Root Rots | | All Diseases | |
| | | % | Short Tons | % | Short Tons | % | Short Tons | % | Short Tons | % | Short Tons |
| Maine | 1,910 | - | - | - | - | t | + | t | + | t | + |
| N.Y. | 13,180 | - | - | t | + | t | + | 8. | 1,146 | 8. | 1,146 |
| Pa. | 4,040 | - | - | 1. | 48 | t | + | 15. | 722 | 16. | 770 |
| Ohio | 2,800 | t | + | 1. | 29 | 0.5 | 15 | 2. | 58 | 3.5 | 102 |
| *Ind. | 6,120 | - | - | - | - | - | - | - | - | - | - |
| Ill. | 12,300 | - | - | - | - | - | - | 1. | 127 | 3. | 381 |
| Mich. | 7,030 | 0.1 | 7 | 1. | 72 | 0.1 | 7 | 1. | 72 | 2.3 | 165 |
| Wis. | 43,200 | t | + | 1. | 448 | 0. | 0 | 2. | 895 | 3.5 | 1,567 |
| *Minn. | 14,000 | - | - | - | - | - | - | - | - | - | - |
| Iowa | | 0. | 0 | 2. | + | 0. | 0 | 0. | 0 | 2. | + |
| Del. | 1,500 | - | - | - | - | t | + | t | + | t | + |
| Md. | 11,120 | 0.2 | 24 | t | + | 0.3 | 35 | 5. | 588 | 5.5 | 647 |
| Va. | 3,020 | t | + | - | - | - | - | 2. | 62 | 2. | 62 |
| Okla. | | 4. | + | 2. | + | - | - | - | - | 9. | + |
| Texas | | t | + | t | + | 0. | 0 | 10. | + | 15. | + |
| Mont. | 2,140 | t | + | t | + | t | + | 8. | 186 | 8. | 186 |
| Idaho | | t | + | 1. | + | 0. | 0 | 10. | + | 11. | + |
| Wyo. | | t | + | t | + | - | - | t | + | t | + |
| Colo. | 3,510 | t | + | 0. | 0 | 5. | 240 | 20. | 962 | 27. | 1,298 |
| Utah | 12,060 | - | - | t | + | - | - | 5. | 645 | 6.5 | 838 |
| *Wash. | 26,250 | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 12,840 | 0. | 0 | t | + | 1. | 140 | - | - | 8.5 | 1,192 |
| **Other States | 10,360 | | | | | | | | | | |
| U. S. | 187,380 | t | 31 | 0.4 | 597 | 0.3 | 437 | 3.9 | 5,463 | 6. | 8,354 |

* Omitted in calculations for U. S. percentage loss.

** Includes California, Idaho, Iowa, Kansas, Nebraska, New Jersey, Oklahoma, Tennessee, Texas, and Wyoming.

Table 15. Green peas for market; estimated reduction in yield due to bacterial blight (Bacterium pisi), Fusarium wilt (Fusarium orthoceras pisi), Ascochyta blight (Mycosphaerella pinodes and Ascochyta spp.), root rots (various organisms), and other diseases, 1936.

| State | Production 1,000 °Bushels | Bacterial Blight % | Bacterial Blight 1,000 Bushels | Fusarium Wilt % | Fusarium Wilt 1,000 Bushels | Ascochyta Blight % | Ascochyta Blight 1,000 Bushels | Root Rots % | Root Rots 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maine | | - | - | - | - | t | + | t | + | t | + |
| Mass. | | 0.5 | + | 4. | + | 2. | + | 25. | + | 31.5 | + |
| Conn. | | - | - | - | - | t | + | t | + | 1.5 | + |
| N. Y. | 321 | - | - | t | + | t | + | 8. | 28 | 8. | 28 |
| *N. J. | 180 | - | - | - | - | - | - | - | - | - | - |
| Pa. | | - | - | 1. | + | t | + | 15. | + | 16. | + |
| Ohio | | t | + | 1. | + | 0.5 | + | 2. | + | 3.5 | + |
| Ill. | | - | - | - | - | - | - | 1. | + | 3. | + |
| Mich. | | 0.1 | + | 1. | + | 0.1 | + | 1. | + | 2.3 | + |
| Wis. | | t | + | 1. | + | 0. | 0 | 2. | + | 3.5 | + |
| Iowa | | 0. | 0 | 2. | + | 0. | 0 | 0. | 0 | 2. | + |
| N. D. | | - | - | t | + | 0. | 0 | 0.5 | + | 0.5 | + |
| Del. | | - | - | - | - | t | + | t | + | t | + |
| Md. | 11 | 0.2 | + | t | + | 0.3 | + | 5. | 1 | 5.5 | 1 |
| Va. | 88 | t | + | - | - | - | - | 2. | 2 | 2. | 2 |
| N. C. | 190 | 1. | 2 | 3. | 6 | 3. | 6 | 1. | 2 | 10. | 20 |
| *S. C. | 175 | - | - | - | - | - | - | - | - | - | - |
| Ga. | | - | - | - | - | 5. | + | - | - | 10. | + |
| Fla. | 508 | 1. | 6 | - | - | 1. | 6 | 10. | 61 | 17. | 104 |
| *Miss. | 192 | t | + | - | - | - | - | - | - | - | - |
| La. | 52 | - | - | - | - | 2. | 1 | - | - | 2. | 1 |
| Okla. | | 4. | + | 2. | + | - | - | - | - | 9. | + |
| Texas | 312 | t | + | t | + | 0. | 0 | 10. | 37 | 15. | 55 |
| Mont. | | t | + | t | + | t | + | 8. | + | 8. | + |
| Idaho | 440 | t | + | 1. | 5 | 0. | 0 | 10. | 49 | 11. | 54 |
| Wyo. | | t | + | t | + | - | - | t | + | t | + |
| Colo. | 760 | t | + | 0. | 0 | 5. | 52 | 20. | 208 | 27. | 281 |
| *Ariz. | 34 | - | - | - | - | - | - | - | - | - | - |
| Utah | | - | - | t | + | - | - | 5. | + | 6.5 | + |
| *Wash. | 1,140 | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 105 | 0. | 0 | t | + | 1. | 1 | - | - | 8.5 | 10 |
| *Calif. | 4,660 | - | - | - | - | - | - | - | - | - | - |
| U. S. | 9,168 | 0.2 | 8 | 0.3 | 11 | 2. | 66 | 11.6 | 388 | 16.6 | 556 |

° Bushels of 30 pounds.

* Omitted in calculations for U. S. percentage loss.

Table 16. Estimated reduction in yield of cotton due to Anthracnose (*Glomerella gossypii*), angular leaf spot (*Bacterium malvacearum*), wilt (*Fusarium vasinfectum*), root knot (*Heterodera marioni*), root rot (*Phymatotrichum omnivorum*), malnutrition (non-parasitic), and other diseases, 1936.

| State | Production 1,000 °Bales | Anthracnose % | Anthracnose 1,000 Bales | Angular Leaf Spot % | Angular Leaf Spot 1,000 Bales | Wilt % | Wilt 1,000 Bales | Root Knot % | Root Knot 1,000 Bales | Root Rot % | Root Rot 1,000 Bales | Malnutrition % | Malnutrition 1,000 Bales | All Diseases % | All Diseases 1,000 Bales |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Mo. | 310 | - | - | - | - | - | - | - | - | 0. | 0 | - | - | - | - |
| Va. | 34 | 2. | 1 | 4. | 2 | - | - | - | - | 0. | 0 | 1. | + | 8. | 3 |
| N.C. | 612 | t | + | 3. | 25 | 5. | 42 | 2. | 17 | 0. | 0 | 17. | 142 | 27. | 226 |
| *S.C. | 820 | - | - | - | - | - | - | - | - | 0. | 0 | - | - | - | - |
| Ga. | 1,090 | 0.1 | 1 | 2. | 26 | 8. | 103 | 0.5 | 6 | 0. | 0 | 2. | 26 | 15.6 | 201 |
| *Fla. | 32 | - | - | - | - | - | - | - | - | 0. | 0 | - | - | - | - |
| Tenn. | 431 | t | + | t | + | 4. | 18 | - | - | 0. | 0 | - | - | 4. | 18 |
| Ala. | 1,140 | t | + | t | + | 8. | 111 | 0.5 | 7 | 0. | 0 | 6. | 83 | 17.5 | 242 |
| Miss. | 1,910 | t | + | t | + | 3. | 62 | - | - | 0. | 0 | 2. | 42 | 8. | 166 |
| Ark. | 1,295 | t | + | 1. | 15 | 10. | 152 | 1. | 15 | t | + | 3. | 46 | 15. | 228 |
| La. | 763 | 2. | 18 | 1. | 9 | 4. | 35 | t | + | 0. | 0 | 5. | 44 | 14. | 124 |
| Okla. | 290 | - | - | - | - | - | - | 1. | 3 | 3. | 10 | 2. | 7 | 11. | 36 |
| Texas | 2,945 | t | + | 2. | 72 | 3. | 108 | 0.5 | 13 | 8. | 289 | t | + | 18.5 | 668 |
| N.M. | 110 | - | - | 3. | 4 | - | - | - | - | 0.1 | + | - | - | 6.1 | 8 |
| Ariz. | 170 | - | - | 1. | 2 | - | - | 0.5 | 1 | 5. | 10 | 4. | 8 | 12.5 | 25 |
| Calif. | 440 | - | - | - | - | - | - | 1. | 5 | - | - | - | - | 3. | 14 |
| * All Others | 15 | | | | | | | | | | | | | | |
| U. S. | 12,407 | 0.2 | 20 | 1.2 | 155 | 4.8 | 631 | 0.5 | 72 | 2.3 | 309 | 3. | 398 | 14.8 | 1,959 |

* Omitted in calculations for U. S. percentage loss.
° 500 pounds.

Table 17. Estimated reduction in yield of sugar beet due to nematode (*Heterodera schachtii*), curly top (virus), leaf spot (*Cercospora beticola*), Phoma rot (*Phoma betae*), and other diseases, 1936.

| State | Production: 1,000 Short Tons | Sugar Beet Nematode % | Sugar Beet Nematode 1,000 Short Tons | Curly-top % | Curly-top 1,000 Short Tons | Leaf Spot % | Leaf Spot 1,000 Short Tons | Phoma Rot % | Phoma Rot 1,000 Short Tons | All Diseases % | All Diseases 1,000 Short Tons |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ohio | 272 | 0. | 0 | 0. | 0 | 1.5 | 5 | 0.5 | 2 | 12. | 38 |
| Mich. | 936 | 0. | 0 | 0. | 0 | 0.1 | 1 | 1.5 | 15 | 5.1 | 51 |
| Wis. | | 0. | 0 | 0. | 0 | 8. | + | t | + | 8. | + |
| Minn. | | 0. | 0 | 0. | 0 | 2. | + | t | + | 12. | + |
| Iowa | | 0. | 0 | 0. | 0 | 2. | + | 1. | + | 10. | + |
| Nebr. | 783 | 1. | 8 | 0. | 0 | t | + | - | - | 5. | 41 |
| Mont. | 649 | t | + | t | + | 1. | 7 | - | - | 6. | 42 |
| Idaho | 724 | - | - | 5. | 38 | - | - | - | - | 5. | 38 |
| Wyo. | 482 | - | - | t | + | t | + | t | + | 7.5 | 39 |
| Colo. | 2,227 | 1. | 25 | t | + | 5. | 125 | t | + | 11. | 275 |
| Utah | 511 | 0.5 | 3 | 5. | 27 | t | + | 0.5 | 3 | 6.5 | 36 |
| Calif. | 1,939 | 5. | 111 | 5. | 111 | - | - | - | - | 13. | 289 |
| Other States | 654 | | | | | | | | | | |
| U. S. | 9,177 | 1.6 | 147 | 1.9 | 176 | 1.5 | 138 | 0.2 | 20 | 9.1 | 849 |

Table 18. Estimated reduction in yield of pear due to blight (Bacillus amylovorus), scab (Venturia pyrina), leaf blight (Fabraea maculata and Mycosphaerella sentina), and other diseases, 1936.

| State | Production: 1,000 Bushels | Blight % | Blight 1,000 Bushels | Scab % | Scab 1,000 Bushels | Leaf Blight % | Leaf Blight 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|
| Maine | 5 | - | - | - | - | - | - | - | - |
| N. H. | 4 | - | - | - | - | - | - | - | - |
| Vt. | 2 | - | - | - | - | - | - | - | - |
| Mass. | 42 | 5. | 2 | t | + | t | + | 5. | 2 |
| R. I. | 7 | - | - | t | + | - | - | - | - |
| Conn. | 18 | 2. | + | 0.5 | + | 0.5 | + | 4. | 1 |
| N. Y. | 776 | 5. | 41 | t | + | t | + | 5. | 41 |
| N. J. | 94 | - | - | - | - | - | - | - | - |
| Pa. | 279 | 15. | 52 | 1. | 3 | 2. | 7 | 19. | 65 |
| Ohio | 174 | 3.5 | 6 | 0.5 | 1 | 0.1 | + | 4.1 | 7 |
| Ind. | 56 | 8. | 5 | t | + | 2. | 1 | 10. | 6 |
| Ill. | 185 | 10. | 21 | 0. | 0 | 1. | 2 | 11. | 23 |
| Mich. | 763 | 2. | 16 | t | + | 0. | 0 | 2. | 16 |
| Wis. | | 2. | + | 5. | + | 0. | 0 | 7. | + |
| Minn. | | t | + | - | - | - | - | t | + |
| Iowa | 33 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 |
| Mo. | 67 | - | - | - | - | t | + | t | + |
| Nebr. | 13 | - | - | - | - | - | - | - | - |
| Kans. | 22 | - | - | - | - | - | - | - | - |
| Del. | 38 | t | + | - | - | 8. | 3 | 8. | 3 |
| Md. | 110 | 8. | 10 | 0.5 | 1 | 2. | 2 | 10.5 | 13 |
| Va. | 274 | 2. | 6 | t | + | t | + | 2.5 | 7 |
| W. Va. | 16 | 1. | + | 1. | + | 2. | + | 5. | 1 |
| N. C. | 181 | 8. | 17 | 0. | 0 | 5. | 11 | 16. | 34 |
| S. C. | 82 | 10. | 9 | 0. | 0 | 2. | 2 | 12. | 11 |
| Ga. | 189 | 10. | 22 | 0. | 0 | 2. | 4 | 12. | 26 |
| Fla. | 67 | 10. | 7 | 0. | 0 | - | - | 10. | 7 |
| Ky. | 50 | 8. | 4 | - | - | - | - | 8. | 4 |
| Tenn. | 123 | 8. | 11 | - | - | - | - | 8. | 11 |
| Ala. | 295 | 10. | 33 | - | - | - | - | 10. | 33 |
| Miss. | 335 | 20. | 87 | - | - | - | - | 23. | 100 |
| Ark. | 61 | t | + | - | - | - | - | t | + |
| La. | 77 | 10. | 9 | - | - | - | - | 10. | 9 |
| Okla. | 10 | - | - | 1. | + | 1. | + | 2. | + |
| Texas | 325 | 10. | 38 | 0. | 0 | 0. | 0 | 15. | 57 |
| Idaho | 58 | 10. | 7 | 0. | 0 | 0. | 0 | 11. | 8 |
| Colo. | 333 | t | + | 0. | 0 | 0. | 0 | t | + |
| N. M. | 27 | - | - | - | - | - | - | - | - |
| Ariz. | 11 | - | - | - | - | - | - | - | - |
| Utah | 91 | 3. | 3 | - | - | - | - | 4. | 4 |
| Nev. | 8 | - | - | - | - | - | - | - | - |
| Wash. | 5,400 | t | + | - | - | - | - | t | + |
| Oreg. | 3,760 | t | + | - | - | - | - | t | + |
| Calif. | 9,667 | t | + | - | - | - | - | t | + |
| U. S. | 24,128 | 1.6 | 406 | t | 5 | 0.1 | 32 | 1.9 | 489 |

APPLE

Table 19. Estimated reduction in yield of apple due to bitter rot (Glomerella cingulata), black rot (Physalospora obtusa), blotch (Phyllosticta solitaria), cedar rust (Gymnosporangium spp.), blight (Bacillus amylovorus), scab (Venturia inaequalis), and other diseases, 1936.

| State | Production: 1,000 Bushels | Estimated reduction in yield due to diseases | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bitter Rot | | Black Rot | | Blotch | | Cedar Rust | | Blight | | Scab | | All Diseases | |
| | | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels | % | 1,000 Bushels |
| Maine | 576 | - | - | - | - | - | - | t | + | - | - | 2. | 12 | 3. | 18 |
| N. H. | 292 | t | + | t | + | - | - | - | - | t | + | 2. | 6 | 2. | 6 |
| *Vt. | 204 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mass. | 1,716 | t | + | 1. | 19 | - | - | 0.5 | 9 | 0.5 | 9 | 2. | 38 | 9. | 169 |
| R. I. | 207 | - | - | 1. | 2 | 1. | 2 | 2. | 6 | - | - | - | - | 9. | 21 |
| Conn. | 796 | t | + | 1. | 9 | 0. | 0 | 1. | 9 | 1. | 9 | 2.5 | 21 | 6.5 | 57 |
| N. Y. | 10,200 | - | - | t | + | 0. | 0 | 0.5 | 53 | 1. | 107 | 2. | 214 | 4.5 | 481 |
| N. J. | 2,850 | t | + | 3. | 92 | t | + | t | + | 2. | 61 | 2. | 61 | 7. | 214 |
| Pa. | 7,072 | t | + | 3. | 267 | t | + | 0.5 | 44 | 3. | 267 | 10. | 890 | 20.5 | 1,824 |
| Ohio | 2,660 | t | + | 0.1 | 3 | 0.1 | 3 | 0.5 | 14 | 2.5 | 70 | 1.5 | 42 | 4.7 | 132 |
| Ind. | 487 | t | + | t | + | t | + | 3. | 16 | 5. | 27 | 1. | 5 | 9. | 48 |
| Ill. | 1,696 | 0. | 0 | 1. | 18 | t | + | 2. | 36 | 1. | 18 | 1. | 18 | 5. | 90 |
| Mich. | 6,864 | 0. | 0 | t | + | 0. | 0 | 0. | 0 | t | + | 2. | 140 | 2. | 140 |
| Wis. | 1,100 | 0. | 0 | t | + | t | + | 1. | 12 | 2. | 24 | 4. | 47 | 7. | 83 |
| Minn. | 454 | - | - | - | - | - | - | 0.5 | 2 | t | + | 0.5 | 2 | 1. | 4 |
| Iowa | 901 | 0. | 0 | 1. | 10 | 0.5 | 5 | 1. | 10 | 1. | 10 | 5. | 50 | 9.5 | 95 |
| Mo. | 649 | - | - | 0.5 | 3 | t | + | t | + | t | + | 0.1 | 1 | 1.6 | 11 |
| N. D. | | 0. | 0 | 0. | 0 | 0. | 0 | t | + | 1.5 | + | t | + | 2.5 | + |
| *S. D. | 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Nebr. | 236 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Kans. | 225 | - | - | - | - | - | - | - | - | - | - | 1. | 2 | 1. | 2 |
| Del. | 1,365 | t | + | 2. | 29 | - | - | - | - | t | + | 3. | 44 | 6. | 88 |
| Md. | 1,810 | 0.5 | 10 | 1.5 | 30 | 0.5 | 10 | 1. | 20 | 1.5 | 30 | 2. | 40 | 8.5 | 170 |
| Va. | 7,750 | t | + | t | + | t | + | 2.5 | 208 | 2. | 167 | 1.5 | 125 | 7. | 583 |
| W. Va. | 3,520 | t | + | t | + | t | + | t | + | 1. | 37 | 2. | 75 | 6. | 224 |
| N. C. | 2,590 | 1. | 31 | t | + | 1. | 31 | t | + | 8. | 247 | 1. | 31 | 16. | 494 |

Apple. (Continued)

| State | Production: 1,000 Bushels | Bitter Rot % | Bitter Rot 1,000 Bushels | Black Rot % | Black Rot 1,000 Bushels | Blotch % | Blotch 1,000 Bushels | Cedar Rust % | Cedar Rust 1,000 Bushels | Blight % | Blight 1,000 Bushels | Scab % | Scab 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimated reduction in yield due to diseases | | | | | | | | | | | | | |
| S. C. | 220 | 1. | 2 | 1. | 2 | t | + | - | - | - | - | - | - | 2. | 4 |
| Ga. | 851 | 1. | 9 | 2. | 18 | 0.1 | 1 | 0.1 | 1 | 0.1 | 1 | 3. | 27 | 6.3 | 57 |
| Ky. | 572 | t | + | t | + | t | + | t | + | 2. | 12 | 3. | 18 | 6. | 36 |
| *Tenn. | 1,140 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ala. | 576 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Miss. | 160 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ark. | 455 | 0. | 0 | t | + | t | + | t | + | t | + | t | + | 2. | 9 |
| *La. | 14 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Okla. | 15 | - | - | 10. | 2 | 20. | 4 | - | - | - | - | 3. | 1 | 33. | 7 |
| Texas | 105 | t | + | 0.1 | + | 2. | 2 | t | + | 5. | 6 | 0. | 0 | 10.1 | 12 |
| Mont. | 112 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 1. | 1 | t | + | 1. | 1 |
| Idaho | 3,102 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 0.5 | 16 | t | + | 2.5 | 80 |
| *Wyo. | 20 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| Colo. | 1,972 | 0. | 0 | 0. | 0 | 0. | 0 | - | - | t | + | 0. | 0 | t | + |
| *N. M. | 812 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| *Ariz. | 70 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| Utah | 703 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | 1. | 7 | 2. | 14 |
| *Nev. | 53 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| *Wash. | 27,520 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| *Oreg. | 4,368 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| *Calif. | 8,946 | - | - | 0. | 0 | 0. | 0 | - | - | - | - | - | - | - | - |
| U. S. | 108,031 | 0.1 | 52 | 0.7 | 504 | 0.1 | 58 | 0.6 | 440 | 1.6 | 1,119 | 2.8 | 1,917 | 7.5 | 5,174 |

* Omitted in calculations for U. S. percentage loss.

Table 20. Estimated reduction in yield of peach due to leaf curl (Taphrina deformans), brown rot (Sclerotinia fructicola), virus diseases, scab (Cladosporium carpophilum), and other diseases, 1936.

| State | Production 1,000 | Leaf Curl % | Leaf Curl 1,000 Bushels | Brown Rot % | Brown Rot 1,000 Bushels | Virus Diseases % | Virus Diseases 1,000 Bushels | Scab % | Scab 1,000 Bushels | All Diseases % | All Diseases 1,000 Bushels |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *N.H. | 8 | - | - | - | - | - | - | - | - | - | - |
| Mass. | 105 | 0.5 | 1 | 1. | 1 | 1. | 1 | 1. | 1 | 3.5 | 4 |
| R.I. | 28 | 1. | + | 2. | 1 | - | - | t | + | 3. | 1 |
| Conn. | 158 | 0.5 | 1 | 1.5 | 2 | 0.5 | 1 | 1. | 2 | 4.5 | 8 |
| N.Y. | 700 | t | + | 1. | 7 | t | + | t | + | 1. | 7 |
| N.J. | 1,380 | 1. | 15 | 6. | 89 | t | + | t | + | 7. | 104 |
| Pa. | 576 | 1. | 6 | 6. | 39 | 0.5 | 3 | 1. | 6 | 10.5 | 67 |
| Ohio | 168 | t | + | 0.1 | + | t | + | 0.5 | 1 | 0.6 | 1 |
| *Ind. | 12 | - | - | - | - | - | - | - | - | - | - |
| Ill. | 315 | t | + | 1. | 3 | - | - | 0. | 0 | 1. | 3 |
| Mich. | 1,334 | 0. | 0 | t | + | 1. | 13 | t | + | 1. | 13 |
| Iowa | 10 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 | 0. | 0 |
| Mo. | 66 | t | + | - | - | - | - | - | - | t | + |
| *Nebr. | 4 | - | - | - | - | - | - | - | - | - | - |
| *Kans. | 17 | - | - | - | - | - | - | - | - | - | - |
| Del. | 514 | 0.5 | 3 | 1. | 5 | t | + | 1. | 5 | 2.5 | 13 |
| Md. | 363 | 2. | 8 | 6. | 24 | 0.5 | 2 | 1. | 4 | 9.5 | 38 |
| Va. | 570 | 1. | 6 | 2. | 12 | t | + | 1. | 6 | 4. | 24 |
| W.Va. | 100 | 2. | 2 | 1. | 1 | t | + | 1. | 1 | 5. | 5 |
| N.C. | 1,800 | t | + | 7. | 147 | - | - | 1. | 21 | 14. | 294 |
| *S.C. | 1,525 | - | - | - | - | - | - | - | - | - | - |
| Ga. | 5,751 | t | + | 7. | 458 | - | - | 0.1 | 7 | 12.1 | 792 |
| *Fla. | 67 | - | - | - | - | - | - | - | - | - | - |
| Ky. | 110 | t | + | 2. | 2 | 0. | 0 | t | + | 2. | 2 |
| Tenn. | 840 | - | - | 2. | 17 | - | - | - | - | 2. | 17 |
| Ala. | 1,040 | - | - | 2. | 21 | - | - | - | - | 2. | 21 |
| Miss. | 759 | - | - | 5. | 40 | - | - | - | - | 5. | 40 |
| Ark. | 825 | t | + | t | + | - | - | t | + | t | + |
| *La. | 228 | - | - | - | - | - | - | - | - | - | - |
| Okla. | 16 | 0. | 0 | 10. | 2 | - | - | - | - | 10. | 2 |
| Texas | 1,200 | t | + | 2. | 30 | 2. | 30 | 5. | 74 | 19. | 282 |
| Idaho | 139 | t | + | 0. | 0 | 0. | 0 | 0. | 0 | 7. | 10 |
| Colo. | 1,213 | 0. | 0 | 1. | 13 | 3. | 38 | 0. | 0 | 4. | 51 |
| *N.M. | 65 | - | - | - | - | - | - | - | - | - | - |
| *Ariz. | 47 | - | - | - | - | - | - | - | - | - | - |
| Utah | 748 | - | - | - | - | - | - | - | - | 15. | 132 |
| *Nev. | 8 | - | - | - | - | - | - | - | - | - | - |
| *Wash. | 1,424 | - | - | - | - | - | - | - | - | - | - |
| Oreg. | 258 | - | - | 12.5 | 37 | - | - | - | - | 12.5 | 37 |
| *Calif. | 21,627 | - | - | - | - | - | - | - | - | - | - |
| U. S. | 46,118 | 0.2 | 42 | 4.1 | 951 | 0.4 | 88 | 0.6 | 128 | 8.6 | 1,968 |

* Omitted in calculations for U. S. percentage loss.

Table 21. Estimated reduction in yield of cherry due to brown rot (*Sclerotinia fructicola*), leaf spot (*Coccomyces hiemalis*), and other diseases, 1936.

| State | Production Tons | Brown Rot % | Brown Rot Tons | Leaf Spot % | Leaf Spot Tons | All Diseases % | All Diseases Tons |
|---|---|---|---|---|---|---|---|
| Mass. | | 10. | + | 0.5 | + | 10.5 | + |
| R. I. | | 25. | + | t | + | 25. | + |
| Conn. | | 2. | + | 1. | + | 3.5 | + |
| N. Y. | 12,840 | t | + | t | + | 1. | 130 |
| N. J. | | 2. | + | 4. | + | 7. | + |
| Pa. | 3,630 | 10. | 437 | 5. | 219 | 17. | 743 |
| Ohio | 770 | 0.1 | 1 | 0.2 | 2 | 0.3 | 3 |
| Ill. | | t | + | t | + | t | + |
| Mich. | 27,450 | t | + | t | + | t | + |
| Wis. | 1,700 | t | + | 4. | 71 | 4. | 71 |
| Iowa | | 0. | 0 | 1. | + | 1. | + |
| Del. | | 1. | + | 5. | + | 6. | + |
| Md. | | 3. | + | 3. | + | 6. | + |
| Va. | | 2. | + | 3. | + | 5. | + |
| W. Va. | | 1. | + | 5. | + | 7. | + |
| N. C. | | 15. | + | t | + | 17. | + |
| Ark. | | t | + | t | + | 1. | + |
| Okla. | | 2. | + | 2. | + | 4. | + |
| Texas | | t | + | - | - | 1. | + |
| *Mont. | 130 | - | - | - | - | - | - |
| Idaho | 1,890 | 0. | 0 | 0. | 0 | 1. | 19 |
| Colo. | 810 | 0. | 0 | 0. | 0 | 0. | 0 |
| Utah | 5,330 | - | - | - | - | 5. | 281 |
| *Wash. | 15,000 | - | - | - | - | - | - |
| Oreg. | 14,500 | 12.5 | 2,071 | - | - | 12.5 | 2,071 |
| *Calif. | 22,000 | - | - | - | - | - | - |
| U. S. | 106,050 | 3.2 | 2,509 | 0.4 | 292 | 4.3 | 3,318 |

* Omitted in calculations for U. S. percentage loss.

Table 22. Estimated reduction in yield due to black rot (Guignardia bidwellii), and other diseases, 1936.

East of Rocky Mountains

| State | Production Tons | Black Rot % | Black Rot Tons | Other Diseases % | Other Diseases Tons | All Diseases % | All Diseases Tons |
|---|---|---|---|---|---|---|---|
| *Maine | 10 | - | - | - | - | - | - |
| *N. H. | 20 | - | - | - | - | - | - |
| *Vt. | 10 | - | - | - | - | - | - |
| Mass. | 320 | 2. | 7 | 4. | 14 | 6. | 21 |
| R. I. | 200 | 1. | 2 | t | + | 1. | 2 |
| Conn. | 1,160 | 1. | 12 | 1. | 12 | 2. | 24 |
| N. Y. | 41,800 | 1. | 440 | 4. | 1,760 | 5. | 2,200 |
| N. J. | 2,600 | 5. | 144 | 5. | 144 | 10. | 288 |
| Pa. | 15,800 | 15. | 2,855 | 2. | 381 | 17. | 3,236 |
| Ohio | 22,000 | 1.5 | 335 | 0.1 | 22 | 1.6 | 357 |
| Ind. | 1,700 | t | + | t | + | t | + |
| Ill. | 3,500 | t | + | - | - | t | + |
| Mich. | 37,400 | t | + | 1. | 378 | 1. | 378 |
| Wis. | 240 | 1. | 2 | 2. | 5 | 3. | 7 |
| Minn. | 210 | 0. | 0 | t | + | t | + |
| Iowa | 3,200 | t | + | t | + | t | + |
| Mo. | 4,700 | t | + | - | - | t | + |
| *Nebr. | 1,000 | - | - | - | - | - | - |
| *Kans. | 1,100 | - | - | - | - | - | - |
| Del. | 2,500 | 3. | 77 | t | + | 3. | 77 |
| Md. | 690 | 8. | 61 | 2. | 15 | 10. | 76 |
| Va. | 1,500 | 15. | 281 | 5. | 94 | 20. | 375 |
| W. Va. | 540 | 3. | 18 | 7. | 42 | 10. | 60 |
| N. C. | 4,500 | 3. | 147 | 5. | 245 | 8. | 392 |
| *S. C. | 980 | - | - | - | - | - | - |
| Ga. | 770 | 10. | 103 | 15. | 154 | 25. | 257 |
| Fla. | 1,090 | 25. | 389 | 5. | 78 | 30. | 467 |
| Ky. | 950 | t | + | - | - | t | + |
| Tenn. | 1,050 | t | + | - | - | t | + |
| Ala. | 580 | 5. | 32 | 5. | 32 | 10. | 64 |
| Miss. | 230 | 15. | 46 | 10. | 31 | 25. | 77 |
| Ark. | 10,600 | t | + | 1. | 107 | 1. | 107 |
| *La. | 60 | - | - | - | - | - | - |
| Okla. | 1,000 | 10. | 125 | 10. | 125 | 20. | 250 |
| Texas | 1,500 | 15. | 281 | 5. | 94 | 20. | 375 |
| Reporting Area | 165,510 | 3.1 | 5,357 | 2.2 | 3,733 | 5.3 | 9,090 |

* Omitted in calculations for total percentage loss.

Table 23. Estimated reduction in yield of strawberry due to leaf spot (Mycosphaerella fragariae), leaf scorch (Diplocarpon earliana), dwarf (Aphelenchoides fragariae), black root and root rot (various causes), and other diseases and estimated loss from fruit rots, 1936.

| State | Production | Estimated reduction in yield due to diseases | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Leaf Spot | | Leaf Scorch | | Dwarf | | Black Root & Root Rots | | All Diseases | | Fruit Rots | |
| | 1,000 Crates | % | 1,000 Crates | % | 1,000 Crates | % | 1,000 Crates | % | 1,000 Crates | % | 1,000 Crates | % | 1,000 Crates |
| Maine | | t | + | - | - | - | - | t | + | - | - | - | - |
| Mass. | | 1. | + | - | - | t | + | 10. | + | 11. | + | 10. | + |
| R.I. | | 5. | + | - | - | - | - | - | - | 5. | + | - | - |
| Conn. | | 1. | + | 1. | + | 1. | + | - | - | 4.5 | + | - | - |
| *N.Y. | 252 | t | + | - | - | - | - | - | - | - | - | - | - |
| *N.J. | 187 | - | - | - | - | - | - | - | - | - | - | - | - |
| Pa. | 286 | 1. | 3 | 0.5 | 2 | 0. | 0 | 10. | 32 | 11.5 | 37 | - | - |
| Ohio | 240 | 0.2 | 1 | - | - | 0. | 0 | 1. | 2 | 1.2 | 3 | - | - |
| *Ind. | 135 | t | + | - | - | 0. | 0 | - | - | - | - | - | - |
| Ill. | 252 | t | + | 0. | 0 | 0. | 0 | 5. | 13 | 5. | 13 | - | - |
| Mich. | 770 | t | + | t | + | 0. | 0 | 10. | 86 | 10. | 86 | - | - |
| Wis. | 94 | t | + | t | + | 0. | 0 | 4. | 4 | 8. | 8 | - | - |
| Minn. | | t | + | - | - | 0. | 0 | 25.** | + | 25. | + | - | - |
| Iowa | 30 | 3. | 1 | 0. | 0 | 0. | 0 | 1. | + | 5. | 2 | - | - |
| Mo. | 301 | t | + | - | - | - | - | - | - | 1. | 3 | - | - |
| Kans. | 40 | t | + | - | - | - | - | - | - | t | + | 1. | + |
| Del. | 182 | t | + | t | + | - | - | - | - | 10. | 20 | - | - |
| Md. | 338 | 1. | 4 | 1.5 | 6 | t | + | 7. | 26 | 9.5 | 36 | 3. | 10 |
| Va. | 427 | 10. | 61 | 5. | 31 | - | - | 15. | 92 | 30. | 184 | - | - |
| W.Va. | | t | + | t | + | - | - | 2. | + | 5. | + | - | - |
| N.C. | 519 | 3. | 19 | 3. | 19 | 5. | 31 | - | - | 16. | 100 | - | - |
| *S.C. | 38 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ga. | 41 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Fla. | 445 | - | - | - | - | - | - | - | - | - | - | 25. | 111 |
| Ky. | 189 | t | + | - | - | 0. | 0 | - | - | t | + | - | - |
| *Tenn. | 437 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ala. | 184 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Miss. | 22 | - | - | - | - | - | - | - | - | - | - | - | - |
| Ark. | 496 | t | + | t | + | t | + | - | - | 1. | 5 | - | - |
| La. | 1,243 | 10. | 148 | 2. | 30 | t | + | - | - | 16. | 237 | 3. | 37 |
| Okla. | 15 | 0.5 | + | 3. | 1 | - | - | 15. | 3 | 28.5 | 6 | - | - |
| Texas | 156 | 1. | 2 | t | + | t | + | 10. | 19 | 16. | 30 | - | - |
| Mont. | | t | + | 0. | 0 | 0. | 0 | 25. | + | 25. | + | - | - |
| Idaho | | t | + | 0. | 0 | 0. | 0 | 5. | + | 15. | + | - | - |
| Wyo. | | t | + | 0. | 0 | 0. | 0 | t | + | t | + | - | - |
| Colo. | | 0. | 0 | 0. | 0 | 0. | 0 | 15. | + | 15. | + | - | - |
| Utah | 55 | - | - | - | - | 0. | 0 | 15. | 11 | 23. | 17 | - | - |
| *Wash. | 800 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Oreg. | 1,142 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Calif. | 694 | - | - | - | - | - | - | - | - | - | - | - | - |
| U.S. | 10,010 | 3.7 | 239 | 1.4 | 89 | 0.5 | 31 | 4.5 | 288 | 12.3 | 787 | - | - |

* Omitted in calculations for U. S. percentage loss.

** Includes winter injury.

# FRUIT AND VEGETABLE DISEASES ON THE CHICAGO MARKET IN 1936

By G. B. Ramsey, Senior Pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry.

Plant Disease Reporter
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During the year 1936, 70,077 [1] cars of fruits and vegetables were used in the Chicago area. In addition to this amount it is estimated that 5511 carloads were received by truck. Over 4,000 carloads of fruits and vegetables were trucked in from Michigan and Illinois, the remainder came chiefly from Wisconsin, Ohio, Tennessee, Missouri, and Indiana, although 17 came from Florida. Thorough inspections were made by the Bureau of Agricultural Economics of over 2,000 of these cars received by freight and express. Diagnoses of the diseases found were made by the writer or under his supervision, and in addition to the data thus collected notes were taken concerning the prevalence of diseases found during weekly trips on South Water Market. Obviously it is possible to see only a small fraction of the fruit and vegetable produce received. The percentage figures given in this report do not represent averages but are accurate percentages of decay found in certain lots of produce from definite localities during certain periods of the year.

The successful transporation of most fresh fruits and vegetables has become such a commonplace matter that few realize the tremendous importance of the developments in this great industry. It is taken for granted that one can go to the market at any time and buy anything he wishes. As a matter of fact, most fruits and vegetables can be obtained in the fresh state in the larger cities practically every month of the year. Even such fruits as strawberries and watermelons, that were once available for only a relatively short period each year, are now available in large quantities for six or eight months.

Most States contribute one or more products and some furnish over half of certain commodities marketed during a year. The following table shows the State of origin and the number of carloads of certain fruits and vegetables used in Chicago during 1936, and a comparison of these shipments with the total number of carloads of the commodity received from all regions.

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[1] Arrivals and unloads of fresh fruits and vegetables at Chicago. Annual Report calendar year 1936. A. B. Farlinger, Bureau of Agricultural Economics.

| Product | Origin | Number of Carloads | Percent of Total Carloads Used in Chicago |
|---|---|---|---|
| Apples | Washington | 2129 | 65 |
| Beans | Florida | 523 | 50 |
| Cabbage | Texas | 876 | 40 |
| Carrots | California | 1274 | 90 |
| Grapefruit | Texas | 841 | 44 |
| | Florida | 812 | 43 |
| Lettuce | California | 3225 | 72 |
| Onions | Texas | 644 | 25 |
| Oranges | California | 3954 | 68 |
| | Florida | 1552 | 26 |
| Potatoes | Idaho | 4391 | 27 |
| Tomatoes | Texas | 598 | 22 |
| | California | 463 | 17 |
| | Florida | 440 | 16 |
| | Mexico | 403 | 15 |
| Strawberries | Louisiana | 522 | 81 |
| | Florida | 104 | 16 |
| Watermelons | Georgia | 676 | 27 |
| | Mississippi | 624 | 25 |
| | Missouri | 530 | 21 |

From this table it will be seen that fruits and vegetables travel great distances even to such centrally located cities as Chicago. Excluding local produce hauled by truck, approximately 22 percent of the fresh fruits and vegetables received on the Chicago market travels 500 miles; 25 percent, 1,000 miles; 10 percent, 1,500 miles; 33 percent, 2,000 miles; and 10 percent (mostly bananas), 2,500 miles or more. The products used in making a relatively simple fruit or vegetable salad have sometimes traveled more than 5,000 miles before they reach our table.

Considering the fact that so much of our fresh fruit and vegetable produce does travel such great distances it is remarkable that so little is lost on account of disease. Transportation test shipments and storage experiments by the Department of Agriculture have done much to demonstrate better methods of precooling and refrigeration to control the development of diseases and to preserve the fresh condition of highly perishable products, but there still remains much to be done along this line. The larger producers, Growers' Associations, and Refrigerator Express Companies appreciate this fact and cooperate heartily in the development of better transportation methods. This accounts for the excellent carrying quality of many of our important products. It is usually the small grower still operating on the theory that "there is a lot of good eating in that spotted apple" who attempts to ship poorly graded products showing evident decay at loading time. The federal-state shipping point inspection service and the federal inspection service at the larger receiving markets are our most effective agencies in demonstrating the necessity for better grading and packing of fruit and vegetable produce in order that the best market values may be obtained.

APPLES:

The storage and market diseases of apples induced by fungi are often relatively unimportant as orchard troubles. Blue mold (*Penicillium expansum*) is an outstanding example of this type of fungus disease. Each year the several varieties of storage apples, Delicious, Rome Beauty, Winesap, and Jonathans, usually show more decay by this fungus than by all the other apple pathogens combined. The highest percentage of decay noted in apples this year was in a load of Oregon Romes marketed in February. The decay in this instance was blue mold rot, ranging from 10 to 50 percent, averaging 30 percent for the load. Blue mold rot also occurred in several lots of Washington Delicious apples marketed during February, March, and April. Many lots showed 4 to 30 percent, the average in most instances being near 10 percent. Blue mold and gray mold (*Botrytis* spp.) were associated in some lots of Illinois Golden Delicious apples marketed in May.

A few Illinois Grimes' Golden apples received in March showed fish-eye rot (*Corticium centrifugum*).

Injuries associated with the various washing processes caused considerable damage to some lots of apples. From 20 to 75 percent of the apples in some boxes of Washington Delicious stock showed brownish discolorations of the skin characteristic of injury by excessively hot washing solutions. Heat injury of a different type also due to hot washing solutions affected 25 percent of some Colorado apples. This injury is characterized by shriveling and numerous small checks and cracks in the skin, generally towards the calyx end of the fruit. Some Idaho Jonathans showed a small percentage of acid bleaching and arsenical burn, but the stock observed here, as a whole, showed relatively little of this injury as compared with 1935.

Although internal breakdown was observed in many lots, this trouble was generally not of great significance. Some cars showed breakdown ranging from 2 to 5 percent, and one car of Washington Jonathans received in February showed 20 percent of this injury.

Most serious scald (30 percent) was found in a few lots of Michigan and Illinois stock.

Soggy breakdown occurred in 15 percent of some Michigan Golden Delicious apples received in December.

York skin-crack injured about 14 percent of the York apples received from Maryland in December.

ARTICHOKES:

The only decay of any consequence on the Globe artichoke is gray mold rot (Botrytis spp.). The stock arriving on this market showed very little decay of this type. Some lots occasionally showed from 1 to 3 percent.

ASPARAGUS:

Most car lots of asparagus are received from California during the months of March and April. The only decays noticed were bacterial soft rot (Bacillus spp.), affecting the butts of the spears, and fusarium rot (Fusarium spp.), affecting the tips. Neither of these decays was serious, the percentage of infected stock being generally less than 5 percent.

BANANAS:

Practically all bananas that are ripe enough for the retail trade show some anthracnose (Colletotrichum musarum). The skin discoloration and the slight decay produced is usually of no great importance; however, in some bunches anthracnose causes serious decay of the fruit at the point of attachment to the stem.

The most serious marketing factors are bruises and discolorations due to rough handling. Occasionally some stock is also discolored by ammonia fumes in the ripening and storage rooms. One lot of bananas inspected in the ripening room showed 75 percent of the stock seriously discolored by ammonia fumes.

BEANS:

Watery soft rot (Sclerotinia sclerotiorum) caused the most serious decay of beans during the year. A car of New Jersey beans showed this decay ranging from 2 to 25 percent, the average being 18 percent. Much of this stock was badly nested. Florida and Louisiana beans showed anthracnose (Colletotrichum lindemuthianum) ranging from 2 to 12 percent, but the average was usually about 3 percent for most lots. Bacterial blight (Bacterium phaseoli) occurred in California and Florida stock to a slight extent.

Russeting (physiological) is often one of the most serious marketing factors of green and wax beans. This discoloration was serious enough in some lots of Florida beans to cause a depreciation of 25 percent in their market value.

BROCCOLI:

There was no serious decay observed in the broccoli arriving on this market. Yellowing and spreading of the flower heads due to over-maturity was one of the most important marketing factors.

CABBAGE:

Bacterial soft rot caused by far the most decay in cabbages on the market. This decay usually shows up at the stump and involves one to three outer leaves of the heads. This disease is especially serious in young cabbage which is subjected to bruising. Decay of this type sometimes ranged to as high as 45 percent, but in most instances the average was near 12 percent.

A few lots of cabbage from various regions showed some alternaria leaf spot (Alternaria brassicae), but in most instances this blemish was not of much significance.

CARROTS:

The carrots received on the market this year often showed an unusually high percentage of watery soft rot (Sclerotinia sclerotiorum). This is especially true of California stock received during the last of August and the first of September. Some cars at this time showed a range of from 15 to 50 percent of watery soft rot, the average being 30 percent. Some lots of California carrots marketed in August also showed as high as 75 percent of bacterial soft rot in the tops.

One lot of California carrots received in June showed an unusual type of blemish of the root. This blemish appeared similar to scab at the point of emergence of the secondary roots, but in many instances there was a slight decay in evidence. All fungi isolated from this tissue proved to be species of Fusarium.

CAULIFLOWER:

About the only disease of importance in cauliflower was bacterial soft rot. This decay is present in the stock from most regions, especially where there is evidence of rough handling. Decay of this type often ranges between 5 and 15 percent. Gray mold rot and black mold rot (Alternaria spp.) were noted in some Oregon stock received in October.

CELERY:

Most of the celery received on this market comes from Florida and California. The stock from each of these states showed an unusually high percentage of watery soft rot (Sclerotinia sclerotiorum). In the Florida celery received during April and May watery soft rot affected 80 percent of the stock in some cars.

Bacterial soft rot also caused serious decay in some Florida cars. One car in particular had an average of 60 percent infected branches showing early stages of decay. As is usual, the celery from most regions showed some infection by early blight (Cercospora apii) and late blight (Septoria spp.), but in most instances these diseases did not seriously affect the marketability of the celery.

Black heart (physiological) was found in both the California and Florida stock, sometimes ranging to as high as 5 percent.

CHICORY:

Bacterial soft rot is the most common market disease of chicory. This disease is prominent in badly bruised stock and also follows in brownish discolored areas in the leaf margins of the heart region. Some lots of chicory from Arizona and California showed as high as 30 to 40 percent of the heart leaves with these brownish discolored margins and tips. The early stages of this discoloration appear to be due to physiological causes rather than to bacterial infection.

CORN:

The ear-worm is still the most serious marketing factor in green corn. Occasionally some bacterial soft rot follows in this injured tissue, but the disease itself is seldom of any consequence.

CUCUMBER:

Bacterial spot (Bacterium lachrymans) caused especially heavy losses in Florida stock marketed during the last of April and the first half of May. Fifty percent of the fruits in some cars were affected. Frequently these infected areas are not large and do not develop serious decay, but in a great number of instances it appears that the common bacterial soft rot organism also invades these regions and the combined bacteria induce a rapidly advancing decay.

Much of the stock received from Cuba showed 5 to 10 percent of bacterial spot followed by bacterial soft rot.

The most serious marketing factors were the shriveled ends and discolorations which sometimes affected more than half of the stock. Generally speaking, the spongy and shriveled ends and discolorations cause a greater market depreciation than any of the diseases.

Cottony leak (Pythium spp.) was found affecting 2 percent of the cucumbers received from South Carolina in June.

EGGPLANT:

A great many of the eggplant shipments from Cuba as well as from Florida showed high percentages of fruit rot (Phomopsis vexans). This decay develops very rapidly during transit, and it is not unusual to find many spots 2 to 3 inches in diameter by the time the stock is received on the market. One lot of Cuban stock received in February showed from 10 to 25 percent of Phomopsis fruit rot.

GARLIC:

The only decay of importance in garlic was blue mold (Penicillium spp.). In one car received from California in November this decay ranged to as high as 17 percent.

GRAPES:

The most serious decay of California grapes is induced by gray mold and by blue mold. The blue mold rot is especially serious in stock that shows split or crushed berries. Gray mold rot sometimes causes serious loss during transit and marketing, but it is also a very serious decay which develops in storage stock.

GRAPEFRUIT:

Most of the grapefruit received on this market come from Texas and Florida. The stock from each of these States showed some stem-end rot (Phomopsis and Diplodia), the usual range of infection being 1 to 5 percent, but in some instances ranging as high as 18 percent with an average of 10 percent. Blue mold rot (Penicillium italicum) was found in small percentages in many lots.

Pox and other physiological blemishes of the skin frequently cause greater reduction in the market value of the shipments than the fungous diseases.

LEMON:

Green mold rot (Penicillium digitatum) was the only parasitic disease of lemons noted. In many lots this rot occurred in from 1 to 10 percent of the stock, the average being about 5 percent. One lot of lemons marketed in October showed an appreciable percentage of albedo browning.

LETTUCE:

Bacterial soft rot is by far the most serious market and transit disease of lettuce. This product from all localities shows some of this decay, and, in some instances, practically 100 percent of the heads may show infection. For example, a car of Washington lettuce received in June showed from 60 to 95 percent (average 80 percent) of the heads having from two to eight outer leaves infected. Many cars of stock from California showed a range of from 1 to 40 percent decay, the average often being about 25 percent. In most all instances the decay is confined to one to three outer leaves. These leaves may be trimmed off and heads marketed immediately without serious loss. However, if badly affected stock is not trimmed and sold soon after it is taken out of the refrigerator, serious decay develops throughout the heads and great losses are sustained.

The most serious blemish of lettuce, tip-burn, frequently offers an opening for bacterial infections. In numerous instances it is found that a high percentage of bacterial soft rot is associated with a high percentage of tip-burn.

In occasional cars a blemish known as ice-burn was noted. This trouble is brought about by packing finely crushed under-cooled ice in the packages.

OLIVES:

There are not many fresh green olives shipped to this market but occasionally a carload is received. No decay of any consequence has been observed in this stock, but in green olives that have been held in cold storage a serious internal browning has been noted. One lot of California olives received in October showed over 50 percent of the stock with internal discoloration. The surface tissues of this fruit appear green and normal in every respect during the early stages of the development of the internal browning. In the final stages, the surface tissue also becomes brown and in a few instances this broken down tissue had become affected with alternaria rot (Alternaria spp.).

ONIONS:

Gray mold rot was present to some extent in practically all storage lots of onions. A number of inspections showed this disease present in 1 to 15 percent of Colorado, Idaho, California, Texas, Louisiana, and Michigan stock. The most serious decay noted was in a lot of Minnesota onions marketed in April which had an average of 30 percent gray mold rot. A lot of Texas onions received in May showed a range of from 3 to 45 percent, with an average of 17 percent gray mold rot.

Bacterial soft rot affected 12 percent of some California onions that showed sun-scald. One car of Texas onions shipped in July showed black mold rot (Aspergillus niger) and rhizopus rot ranging from 12 to 75 percent, with an average of 35 percent. These decays are frequently serious in stock that is not well cured or that has become moist and warm during transit. Louisiana onions received in May showed a very high percentage of decay in which Macrosporium, Fusarium, and bacteria were associated. In two car-lots examined, the range of decay was from 18 to 50 percent, the average being 35 percent.

Storage breakdown was found in two lots of onions; one from Michigan had 10 percent and one from Minnesota had 20 percent of this type of injury. Both of these lots showing storage breakdown also showed gray mold rot.

ORANGES:

The ubiquitous blue mold (Penicillium italicum) caused some damage to oranges from all regions, the average percentage of decay in most cars, however, being not more than 5 percent. The greatest amount of blue mold found in any one car was in a shipment of Florida stock received in January that showed a range of decay of from 10 to 55 percent, averaging 30 percent for the load.

Stem-end rot (*Phomopsis* and *Diplodia*) was present in small amounts (2 to 4 percent) in Florida stock, and in an occasional car the decay ranged from 10 to 15 percent.

Several lots of Florida oranges showed 5 to 15 percent with brown to brownish-red discolored sunken areas and spots, usually near the stem-end, which appeared to be associated with the "color added" process.

A few cars of California stock showed a small percentage of anthracnose stem-end rot (*Colletotrichum gloeosporioides*).

PEACHES:

As usual, brown rot (*Sclerotinia fructicola*) and rhizopus rot (*Rhizopus* spp.) caused most damage to peaches received on the market. Georgia, Tennessee, and Illinois stock showed an average of about 5 percent brown rot in many cars. In most cars rhizopus rot caused fully as much damage as the brown rot.

A car of Washington Elbertas received in October showed 50 percent internal breakdown characteristic of cold storage injury.

PEARS:

Gray mold rot was found in a few lots of Oregon Anjou pears marketed in April. The greatest decay noted was in a car showing a range of 1 to 8 percent, with an average of 2 percent. One box in this lot showed 25 percent of gray mold rot.

A bulk car of Indiana Kieffers received in November had 8 percent of blue mold and of black rot (*Physalospora obtusa*).

The most interesting decay noted during the year was *Sporotrichum* rot in the Medford, Oregon Anjou pears marketed in February. Up to 40 percent in some boxes showed dark brown to black, circular depressed spots one-fourth to one and one-fourth inches in diameter. The affected internal tissues were yellow-brown to dark-brown and soft to spongy in texture, depending on the size of the lesion. The spots ranged in depth from one-fourth to one-half inch. At room temperature many of these spots were observed to increase in diameter at the rate of one millimeter per day.

PEAS:

Defects such as over-maturity, poorly filled pods, and scars caused greater depreciation in the market value of green peas than any disease. In a great number of cars these defects ranged from 10 to 40 percent. In recent years the Cladosporium scab and distortion of pods due to mosaic infections also contributed largely to the bad appearance of many lots.

Bacterial soft rot was found in occasional lots affecting 2 to 5 percent of the stock. Gray mold rot was observed in a few lots of California peas marketed in May.

PEPPERS:

Rhizopus rot is usually the most common decay of peppers during transit. This disease affected 3 to 7 percent of many lots this year.

Gray mold rot occurs also in transit, but it is most serious in storage peppers. Some lots of California peppers that had been in cold storage showed 90 to 100 percent infection, over half of which was gray mold, the remainder being Cladosporium and Alternaria. Some Texas peppers marketed in November also showed practically 100 percent infection, mostly by Alternaria and Cladosporium but some Botrytis was also present. These three organisms seem to be ever-present in stock held for any length of time in cold storage. A few lots of Texas and Florida stock showed small percentages of bacterial spot (Bacterium vesicatorium). These scab-like blemishes are not of serious consequence unless they are so numerous as to injure the appearance of the stock.

PINEAPPLES:

Black rot (Thielaviopsis paradoxa) was noted in a few carlots of Cuban stock.

A brown rot caused by a species of Fusarium was found causing 5 to 10 percent loss in pineapples from Puerto Rico and Cuba. Brown, slightly sunken spots at the "eyes" near the base of the fruits are characteristic of this disease. The affected areas are brown and usually about one-half inch in diameter and one-half to three-fourths of an inch deep. In advanced stages the brown tissues may become spongy and cavities may form which become lined with the mycelium of the fungus. Blue mold rot and some bacteria are frequently associated in some of these spots.

PLUMS AND PRUNES:

The only disease of importance in the plums and prunes was blue mold rot. This disease was found affecting 10 percent of one large lot of Michigan stock received in September and a car-lot of Idaho stock received in October.

POTATOES:

Bacterial soft rot and the various types of fusarium decays caused the most serious losses of potatoes during the year. The new stock from Florida, Alabama, and Louisiana received during the winter and spring suffered very heavy losses from bacterial soft rot. Several cars showing no apparent sun-scald had an average of 25 percent infection, and some car-lots showing definite sun-scald showed an average of 40 percent infection and a range as high as 80 percent. New Jersey potatoes received in August also showed high percentages of bacterial soft rot. Several cars showed from 5 to 10 percent infection, and in one particular car the range was from 5 to 75 percent, an average of 50 percent of the tubers showing bacterial soft rot. Some New Jersey potatoes also showed 5 to 10 percent of scab (*Actinomyces scabies*).

A number of car-lots of Idaho Russet Burbank potatoes examined in January and February showed 2 to 30 percent decay at the stem-end. Much of this decay was of the jelly-end type in which *Fusarium* was the predominant organism, although occasionally *Rhizoctonia* and some bacteria were present in the more moist lesions.

Fusarium dry-rots (*Fusarium* spp.) were common in storage potatoes from all regions. However, most well-graded stock from Colorado, Idaho, Minnesota, Arizona, and Michigan usually had less than 5 percent of this trouble.

As usual, one of the important marketing factors of potatoes was injuries due to rough handling. Defects ranging to 10 or 15 percent due to mechanical injury were not uncommon. Minnesota, Wisconsin, and North Dakota potatoes showed hollow-heart sometimes ranging to as high as 25 percent in some lots.

For the first time in recent years, leak (*Pythium* spp.) showed up in appreciable amounts in California potatoes received during June and July. In a few cars this decay ranged from 2 to 20 percent, average 8 percent. Leak also was observed in a few Idaho potatoes to the extent of 7 percent when marketed in August.

Fumigation injury due to carbon-bisulphide was serious in a few cars of California potatoes inspected in June. This injury is characterized by brown discolorations in the vascular ring and in the pith region of the tuber. In some potatoes the affected tissues separate and form cavities one-eighth to one-fourth inch wide.

RADISHES:

Bacterial soft rot of the tops was the only disease of market importance affecting bunch radishes.

RHUBARB:

A few lots of Washington and California rhubarb showed high percentages of gray mold rot. For example, one car of Washington stock showed a range of 10 to 70 percent, average 40 percent, and one car of California rhubarb showed an average of 75 percent of gray mold rot affecting one to one and one-half inches of the bases of the stalks.

RUTABAGAS AND TURNIPS:

A large amount of the Canadian rutabagas received this year were protected by a wax or paraffin coating. Most of this stock arrived in good condition as far as decay was concerned. A slight amount of gray mold rot was noted in occasional lots. The Minnesota rutabagas showed some fusarium decay and, in stock showing mechanical injuries, frequently bacterial soft rot was also present.

Downy mildew (Peronospora parasitica) was found in one lot of topped turnips received in February from Brownsville, Texas. Externally the roots looked normal, but, on cutting, grayish to brownish-black discolorations involved practically the whole interior of the root. The characteristic haustoria of this organism were abundant within the affected tissues.

SPINACH:

Bacterial soft rot caused practically all of the serious decay noted in spinach from all shipping regions. Frequently there was only a trace of this trouble, but in many cars the decay ranged to as high as 30 percent, often showing an average of about 15 percent. The chief other marketing factor was yellowish discoloration of the leaves, partially due to age, wind-whipping, and insect injuries. As usual, a great deal of the stock showed some yellowish discoloration due to downy mildew (Peronospora effusa).

SQUASH:

Only one lot of squash showed any decay of interest. This lot, of the Marblehead type from Washington, was received in the middle of January, and at that time it showed numerous brown to black, circular depressed spots, one-fourth to one and one-fourth inches in diameter, which penetrated one-fourth to one inch deep. The decay was spongy, tan to grayish-black and sharply separated from the healthy tissue. Cultures showed most of this decay to be alternaria rot (Alternaria spp.), but in some lesions blue mold rot was associated. This lot was of particular interest because it was allowed to remain in the car on the track until the end of January, and then an inspection was requested for a dumping certificate. On this inspection all fruit showed heavy alternaria decay, some rhizopus rot and some blue mold rot. Four thousand pounds of this stock were dumped on account of these diseases.

STRAWBERRIES:

As usual, many lots of strawberries showed some infection and decay by rhizopus rot, particularly in the top of loads that had not been properly precooled and where the temperature frequently gets high enough to allow development of this organism. Gray mold rot and leather rot (Phytophthora spp.) caused approximately 10 percent decay in some cars of Tennessee berries.

SWEET POTATOES:

Practically every car examined on this market showed some rhizopus rot. The decay varied in different lots from 1 to 70 percent. Many lots showed an average of 10 percent rhizopus rot and occasionally a car would show as much as 25 percent loss on account of this decay.

No other diseases of serious consequence were noted.

TOMATOES:

Phoma rot (Phoma destructiva) caused serious losses in tomatoes from Florida, Cuba, and Mexico. On inspection many cars showed 2 to 25 percent phoma rot on arrival, and when the green stock was held in ripening rooms sometimes over 50 percent loss was sustained before the fruits were ripe enough to market. For example, some Cuban tomatoes examined in the ripening rooms showed a range in decay of from 10 to 90 percent, with an average of 60 percent. Most of this decay was due to Phoma, but some Alternaria and Rhizopus were also present. In a lot of Florida tomatoes inspected in the ripening rooms 8 to 80 percent of the stock was affected with phoma rot in various stages of development. The average decay for the lot was 45 percent. Practically all infections occurred at the stem scar and in small cracks and mechanical injuries about the shoulders of the fruit.

Florida tomatoes received in January and February frequently showed alternaria rot about the stem-end of the fruits. Many lots had 5 to 10 percent of this decay and one car noted showed 8 to 35 percent with an average of 22 percent.

Rhizopus rot occurred in much of the Mexican stock received during February, March, and April. One car examined had up to 40 percent rhizopus rot in some lugs, the average for the load being 20 percent. The Mexican tomatoes received in December frequently showed as much as 30 percent loss due to green mold rot (Cladosporium spp.) and an associated alternaria rot. These diseases were particularly destructive in car-lots that were allowed to stand on track for ripening.

Bacterial soft rot was present to some extent in tomatoes from all regions but it was especially destructive in Texas tomatoes received during May and June. In some cars 50 percent infection was noted and in many the average decay for the load was near 20 percent. Some rhizopus rot and soil rot (Rhizoctonia spp.) and buck-eye rot (Phytophthora terrestris) were also present in Texas tomatoes.

California tomatoes shipped in November were often severely affected with alternaria rot at the stem scar and in mechanical injuries. Many lots showed 10 to 15 percent infection and in some stock practically every fruit was affected. One car in particular showed 40 to 100 percent alternaria rot in various stages, the average for the car being 60 percent. Most infections were in the early stages at the edge of the stem scar and in small injuries and cracks over the shoulders of the fruits. These blemishes and decays greatly reduce the marketability of such stock but do not entirely destroy its value.

Late blight rot (Phytophthora infestans) affected 5 to 25 percent of the tomatoes in many cars of California stock received in November. The greatest decay noted occurred in one car which showed up to 80 percent infection, the average for the load being 50 percent.

California tomatoes also showed some losses due to green mold rot (Cladosporium spp.). This decay was most common in the late fall crop that was harvested just previous to and following light frosts. Virus mottling of the streak and spotted-wilt types was prominent in several lots of California tomatoes in October. Some of these brown loop and circle blemishes continued to become more prominent in stock held on the market. Some green tomatoes that showed only faint traces of mottling when received developed conspicuous loops and circles in three or four days.

Bacterial speck (Bacterium punctulans) was found causing minor blemishes in a few California tomatoes received in October.

WATERMELONS:

Discolorations and blemishes due to bruising were the most important marketing factors for watermelons during the current year. Some car-lots inspected showed as much as 30 percent of the stock badly bruised and discolored. Many melons showed bruised and softened ends and in this injured tissue frequently bacterial soft rot caused serious decay. One lot of Florida melons received in June showed 2 percent stem-end rot (_Diplodia_ spp.). Anthracnose (_Colletotrichum lagenarium_) was not of much importance except in a lot or two of Missouri stock received in August. Hail injury affected 30 percent of a car-lot of Georgia melons received in July. Internal browning (physiological) of the rind was noted in a lot of Cuban Queen melons received from Missouri in August.

# PROCEEDINGS OF THE ROOT-KNOT NEMATODE CONFERENCE

Held at Nashville, Tennessee, Feb. 2 and 3, 1937

Edited by
H. P. Barss, U. S. Department of Agriculture, S. A. Wingard, Virginia Agricultural Experiment Station, and E. M. Buhrer, G. Steiner, and J. Tyler, U.S. Department of Agriculture.

Plant Disease Reporter
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Table of Contents

## ORGANIZATION OF CONFERENCE

The first session of the conference was called to order by Chairman R. F. Poole.

LIST OF THOSE PRESENT:

| | |
|---|---|
| G. M. Armstrong | South Carolina Experiment Station |
| C. H. Arndt | South Carolina Experiment Station |
| H. D. Barker | U.S.D.A., Washington, D. C. |
| H. P. Barss | U.S.D.A., Washington, D. C. |
| H. W. Barre | U.S.D.A., Washington, D. C. |
| K. C. Barrons | Alabama Experiment Station |
| A. N. Brooks | Box 522, Lakeland, Florida. |
| E. M. Buhrer | U.S.D.A., Washington, D. C. |
| E. M. Cralley | Arkansas Experiment Station |
| A. W. Drinkard | Virginia Experiment Station |
| H. A. Edson | U.S.D.A., Washington, D. C. |
| I. L. Forbes | Louisiana Experiment Station |
| U. R. Gore | Georgia Experiment Station |
| J. E. Hite | U.S.D.A., Jackson, Mississippi |
| H. H. Hume | Florida Experiment Station |
| P. H. Kime | U.S.D.A., Raleigh, North Carolina |
| C. J. King | U.S.D.A., Sacaton, Arizona |
| R. A. McGinty | South Carolina Experiment Station |
| H. C. McNamara | U.S.D.A., Greenville, Texas |
| L. E. Miles | Mississippi Experiment Station |
| P. R. Miller | U.S.D.A., Washington, D. C. |
| R. H. Milton | University of Tennessee, Extension Service, Nasnville, Tennessee |
| W. D. Moore | U.S.D.A., Tifton, Georgia |
| E. G. Moss | Tobacco Station, Oxford, North Carolina |
| D. C. Neal | U.S.D.A., Baton Rouge, Louisiana |
| A. G. Plakidas | Louisiana Experiment Station |
| R. F. Poole | North Carolina Experiment Station |
| O. A. Pope | U.S.D.A., Washington, D. C. |
| L. Shaw | North Carolina State College |
| C. D. Sherbakoff | Tennessee Experiment Station |
| D. M. Simpson | U.S.D.A., Knoxville, Tennessee |
| A. L. Smith | Georgia Experiment Station |
| G. Steiner | U.S.D.A., Washington, D. C. |
| J. J. Taubenhaus | Texas Experiment Station |
| A. L. Taylor | U.S.D.A., Tifton, Georgia |
| W. H. Tharp | Fayetteville, Arkansas. |
| H. B. Tisdale | Alabama Experiment Station |
| G. R. Townsend | Florida Everglades Experiment Station |
| J. Tyler | U.S.D.A., Washington, D. C. |

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| J. O. Ware | U.S.D.A., Washington, D. C. |
| J. R. Watson | Florida Experiment Station |
| G. F. Weber | Florida Experiment Station |
| S. A. Wingard | Virginia Experiment Station |
| R. Y. Winters | North Carolina Experiment Station |

THE CALLING OF THE CONFERENCE. At the beginning of the session Dr. S. A. Wingard, Chairman of the Tobacco Disease Council, was asked to explain how the conference came to be called. He showed that it was the outgrowth of the active interest taken in the nematode problem by the Tobacco Disease Council ever since its formation at Greensboro, North Carolina, in November, 1935. This interest had led the Council at its meeting in Tifton, Georgia, in June, 1936, to pass a resolution suggesting the initiation of a regional nematode survey to be participated in by the state experiment stations interested in the problem, with the hope of cooperation from the Tennessee Valley Authority. This matter was brought before a conference of southeastern experiment station directors later in the summer, but because of some doubt as to the practical value and feasibility of such a survey, the matter was referred back to the Council with an expression of the interest of the directors in the root-knot problem and their request that further consideration be given to the best way of approaching the problem of a more effective regional research program aimed at more effective prevention of nematode damage. The executive committee of the Council then met at Atlantic City, December 30, 1936, during the annual meeting of the American Phytopathological Society, and after thorough discussion decided to call those interested in the root-knot nematode problem to a general conference at Nashville, Tennessee, in connection with the meeting of the Association of Southern Agricultural Workers, in order to canvass the present status of scientific knowledge and agricultural practice with regard to this nematode and to consider what steps might be taken by the workers themselves to insure better progress in solving the problem in its various aspects. To the Committee on Root-and-Stem Diseases of the Tobacco Disease Council, with Dr. R. F. Poole as chairman, was assigned the responsibility of arranging for the conference program and sending invitations to workers who might be interested. Dr. Wingard as chairman of the Council also assisted by communicating with directors of experiment stations and with officials of the U. S. Department of Agriculture. That the root-knot nematode problem is viewed as of serious importance to southern agriculture was indicated by the responses received and by the unexpectedly large and representative attendance.

The program, starting Tuesday afternoon, February 2, in the Andrew Jackson Hotel, was continued in the evening and concluded by a session Wednesday morning. It included informal discussions of the root-knot nematode, its life history, response to environmental factors, hosts, means of dissemination, experimental methods, and its control by chemical means, rotation systems and other cultural practices, resistant plants, hot-water treatments, etc., with reviews of recent research presented by the investigators.

Throughout the course of the program there was free and energetic discussion. The need was brought out for much additional work in many directions. Before adjournment the question of how to promote more effective attack on the root-knot nematode problem in the future came up for general consideration and led to a few definite decisions, as follows:

DECISIONS OF THE CONFERENCE. 1. The Proceedings. By general consent it was agreed that the proceedings of the present conference should be prepared, mimeographed, and sent not only to all present but to all others known to be interested, including the directors of experiment stations in the root-knot region.

2. List of Investigators on the Root-Knot Nematode. It was agreed that a mimeographed list of persons now working on the root-knot nematode, indicating the type of investigation in which each is engaged, would be of great value.

3. Future Conferences. It was unanimously voted that occasional conferences of workers on root-knot nematode problems would be desirable.

4. Organizing Committee. On nomination of a special committee appointed for the purpose (Poole, Barre, Weber, Armstrong, Wingard, and Miles) the Conference elected the following as a permanent committee to work out future plans:

Vice-Director H. Harold Hume, Florida Agric. Experiment Station, Gainesville, Florida, Chairman.

Director H. P. Stuckey, Georgia Experiment Station, Experiment, Georgia.

Dr. G. Steiner, Head, Division of Nematology, Bureau of Plant Industry U. S. Department of Agriculture, Washington, D. C.

Dr. C. L. Isbell, Horticulturist, Alabama Experiment Station, Auburn, Alabama.

Dr. R. F. Poole, Plant Pathologist, North Carolina Experiment Station, Raleigh, North Carolina.

Dr. E. E. Clayton, Plant Pathologist, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

The Chairmen of the Tobacco Disease Council and Cotton Disease Council, respectively, were declared ex officio members of the committee.

These men are:

Dr. S. A. Wingard, Plant Pathologist, Virginia Experiment Station, Blacksburg, Virginia.

Dr. G. M. Armstrong, Plant Pathologist, South Carolina Experiment Station, Clemson, South Carolina.

## DIGEST OF THE CONFERENCE PROGRAM

GENERAL FACTS ABOUT THE ROOT-KNOT NEMATODE, Heterodera marioni. Dr. G. Steiner. After outlining the organization of the Division of Nematology in the U. S. Department of Agriculture, with its main office in Washington and field headquarters at Salt Lake City, Utah, Sumner, Washington, and Tifton, Georgia, and with cooperative relations with several other divisions of the Department, Dr. Steiner discussed general facts about the root-knot nematode. It is clearly distinguishable from other nematodes by the pear-shaped adult female and by characteristics of the larval stages. It is able to distinguish host plants by means of a chemical sense organ at the anterior end. The glands in the esophagus produce a substance which is injected through the spear or stylet of the nematode and induces abnormal development of the plant tissues, which are so transformed as to interfere with normal processes in the plant and so cause far more damage than would the mere extraction of nourishment.

The life history was sketched. The larvae, hatched from egg masses, enter the root tips by forcing their way between the epidermal cells and migrating between the cells of the parenchyma, with little or no destruction of cells, thus affording little opportunity for other parasites to enter the root at this time. The head of the larva penetrates the central cylinder, where "giant" cells are formed around its mouth, apparently by the dissolution of some cell walls. From these giant cells the nema now begins to ingest nourishment and swells rapidly. Under adverse conditions, some larvae develop into males and swelling ceases. Normally, however, larvae become females and continue to enlarge until egg production begins. The egg masses may remain within the tissues of the root or they may protrude by rupture of its surface.

The parasite affects the host in three ways:
- (1) Directly by taking food; damage considered small.
- (2) Indirectly by producing disturbance in root tissues and consequently in vital functions. This is considered its principal damage, and was therefore broadly discussed and demonstration material was presented.
- (3) Indirectly by preparing the host for other diseases.
    - (a) Through weakening of the host.
    - (b) Through production of open lesions.

No method of satisfactory therapeutic treatment applied to the host plant has ever been devised for eliminating the nematode from its tissues, except the hot-water treatment which is applied mainly to valuable propagating stock. Control measures must therefore concentrate action on the larvae and eggs free in the soil or remaining in the roots of harvested crops.

The root-knot nematode is distributed throughout the tropics and subtropics, through much of the temperate zone, and in greenhouses everywhere. In the United States this nematode occurs throughout the south and as far north as New Hampshire, New York, northern Michigan, and Washington State. It was prevalent in Florida in the 1860's. Papers by Neal and Atkinson treating this nematode were published in 1889. The egg can survive very low temperatures, but the period of optimum temperature for development is probably too short in the north for more than one generation a year. In the south, however, 8 to 10 generations or more may be produced in a year. It is our conception that the eggs do not require fertilization by a male.

Soil texture will not control nematodes, but a sandy soil is more favorable for them than a clay soil. There is apparently no relation between the nematode and soil reaction, except that coal ashes mixed with soil are said to give control. Further studies are needed to determine the maximum span of life of eggs in the soil. Eggs apparently survive in flooded soil for a year but absolute dryness kills them. However, viable eggs were found in roots of tuberous begonias and kept dry 18 months.

Miss Jocelyn Tyler quoted Godfrey as saying that the nematode will develop under any moisture conditions under which the host plants will live. She also has conducted experiments with nematodes developing in roots submerged in culture solutions. She found that larvae may live for several months in aqueous solutions containing a few sand grains. Egg masses were killed by drying in one afternoon in the laboratory, but thorough drying is difficult in the soil.

HOST PLANTS. Miss Edna M. Buhrer presented an analysis of the root-knot host list.

I. Status of list to date.
   A. 1155 species (published and unpublished) recorded in the Division of Nematology.
   B. Variation of susceptibility.
      1. Ambiguity in various reported hosts (depending on soil, climate, length of time exposed to infestation, efficiency of methods, etc.).

2. Examples: Tomato - heavily infested.
Corn, peanut, onion - variously reported as infested or not.
Grasses, Crotalaria juncea - seldom infested.

II. By classification.

A. Cryptogams (fungi and algae, bryophytes, ferns) - no hosts.

B. Phanerogams or seed plants.

1. Gymnospermae (3 of the 4 families represented on list: Cycadaceae, Ginkgoaceae, Pinaceae.)

2. Angiospermae

a. Monocotyledoneae ) both well represented on list.
b. Dicotyledoneae )

III. Analysis of Phanerogams.

A. By number and families: 118 of a possible 280 families infested - 42 percent.

B. From evolutionary viewpoint, no conclusions can be drawn.

C. Quantitatively per family - by percentage ranging from 0.07 to 100 percent of the species of each family represented on host list.

IV. Discussion of families not known to be attacked (by number, 162).

A. Are they omitted by reason of rare or restricted occurrence, and therefore unobserved as hosts?

B. Are they not infested by reason of their habitat? Examples:

1. Parasitic plants: Loranthaceae (including mistletoe)
Rafflesiaceae (parasitic herbs)
Orobanchaceae (parasitic herbs)

2. Aquatic plants: Potamogetonaceae
Naiadaceae (gen. Najas)
Alismaceae
Hydrocharitaceae
Lemnaceae (free-swimming, perennial, water plants)
Nymphaeaceae (including waterlilies)
Ceratophyllaceae

C. Families not reported infested for unknown reasons, of importance for investigation as rotation possibilities. Examples:

Tamaricaceae (genus Tamarix)
Cistaceae (genus Helianthemum, sunrose, as ornamental)
Elaeagnaceae (genus Hippophaë, as ornamental).
Cornaceae (genus Cornus, dogwood, as ornamental)
Aquifoliaceae (genus Ilex, holly, as ornamental)
Celastraceae (genera Celastrus, bittersweet, and Euonymus, as ornamental)

Hippocastanaceae (genus Aesculus, horsechestnut, as ornamental)
Casuarinaceae (genus Casuarina, as ornamental)
Pandanaceae
Ericaceae (including rhododendron, azalea, as ornamentals)

Crotalaria spectabilis has never been reported as infested although other species of Crotalaria have been found attacked.

For more detailed information on host plants refer to The Plant Disease Reporter, vol. 17, no. 7, June 15, 1933, or correspond with Miss Buhrer. A revised host list is being prepared and suggestions were requested as to the form for rendering it most useful. It was suggested that annotations in the host list indicating something as to relative susceptibility or resistance, where this has been well established or is strongly supported by evidence, would be useful.

The question was raised as to why there were such apparent fluctuations in susceptibility. It was Mr. Taylor's suggestion that the condition of the soil at the time of testing might explain this, that if the soil were too dry the nematodes would go to greater depths. Even on tobacco at Tifton, Georgia, considerable variation has been noticed in the infestation on different plots.

Dr. Taubenhaus inquired about the depth of nematode infestation in soil, and referred to experiments on the control of root rot, in which he had soaked the soil to a depth of two feet with 10 percent sulfuric acid poured into crowbar holes four inches apart.

Dr. Steiner mentioned that most plant nematodes develop strains which prefer particular host species, the hosts inhabited by the parents being preferred by the offspring. In this respect the root-knot nematode is the least developed but there are some indications of specialization. For example, cases have been reported where it was difficult to transfer root-knot nematodes from squash to tomatoes and, again, from tomatoes to lettuce. He reported that in some localities peanuts and corn were not attacked at all, in others, however, quite heavily. Evidence of the formation of geographic strains is lacking.

As to the most susceptible hosts, Miss Buhrer stated that tomato is considered one of the worst, while others indicated squash or tobacco.

Dr. Steiner reported that it was the intention of his Division eventually to publish a technical bulletin which would summarize all the established facts regarding the root-knot nematode. Such a bulletin could not be published at once, however, due to the pressure of other activities.

ARTIFICIAL CULTURE METHODS. Miss Tyler described the experiments of Dr. Christie, of the Division of Nematology, in which he inoculated with individual nematodes the seedling roots of tomato, observing the responses of the host from day to day with results which have enabled him to give a clear picture of the process of gall formation. She reported her method of cultivating nematodes aseptically in tomato seedlings growing in agar or in Pfeffer's solution. An egg mass might be used for the initial infestation, but after one generation in culture it was relatively easy to obtain infestations with single nematodes. This method has been applied to studies of temperature and of sex ratios, and might be usefull for other hife history studies. Dr. Poole mentioned that Dr. Shaw has found sweet potatoes an excellent source of nematodes, uncontaminated because of their location up to one-half inch under the skin.

PARASITES AND OTHER ENEMIES OF THE ROOT-KNOT NEMATODE. Dr. G. Steiner. Free-living nematodes are common in the soil. Some of them are predatory and feed on soil animals, perhaps on rotifers or on small earthworms, and even on other nematodes, as do, for example, the mononchs, a widely distributed group monographed by Cobb. Dr. Steiner has observed a specimen of *Mononchus papillatus* which killed as many as 83 root-knot nematode larvae in a single day. In Indio, California, an attempt was made to colonize mononchs in date-palm plantings heavily attacked by root-knot, but it proved difficult to keep track of these mononchs, and no artificial culture methods are at present known for propagating them on a large scale. Linford and also McBeth have seen certain aphelenchoides feeding on other nematodes. The tripylas and diplogasters also have predatory members, and various dorylaims feed on soil animals. Only the free-living, soil phase of the root-knot nematode is exposed to these attacks. However, rhabditids and diplogasters are possible feeders on the egg masses in decaying roots. There is a chance for important fundamental work along this line.

Zopf, Drechsler, Sherbakoff, and Linford have all reported fungi which trap and kill nematodes. Until recently these nematode-catching fungi had been found in association with free-living nematodes only, but in a recent issue of *Science* Linford presents evidence that they are of real significance in the control of root-knot nematodes in Hawaiian soil. Attention is called to the danger of misinterpreting the results of tests in which large amounts of vegetable matter are added to the soil, since the decay of this material may produce substances which temporarily inhibit the hatching of the nematode eggs. Linford, however, found an increase in the number of nematode-attacking fungi where plant material was incorporated in the soil, and a subsequent reduction in root-knot-nematode activity as measured by test plants. Sporozoa, parasites belonging to the Protozoa, in some instances have been found greatly to reduce free-living nematodes, but have not yet been reported as parasitizing the root-knot nematode.

Other soil organisms may feed on the root-knot nematode. Carnivorous mites may attack sessile females and egg masses. Earthworms may swallow them along with root parts, although it is possible that in this case the eggs might pass through the alimentary tract uninjured. Insects feeding on roots, e.g., the ant, Solenopsis xyloni (now S. germinata var. xyloni), reported by Neal, may also consume egg masses.

RESPONSES TO ENVIRONMENT. Mr. A. L. Taylor reviewed the literature on all phases of this subject.

Temperature: Root-knot infestations have survived in places where the ground froze to a depth of three feet, and again where the air temperature reached -30° F.

Larvae were killed in experiments by Hoshino and Godfrey in less than 1 minute at 48°, in less than 1 hour at 41°, and in 2-1/4 hours at 40° C. Eggs in egg masses were killed in less than 1 minute at 52°, in less than 1 hour at 44°, and in 4-1/2 days at 40° C. These data are valuable guides in heating soil and in treating roots with hot water.

Miss Tyler obtained root penetration by larvae at temperatures from 12° to 35° C., and egg laying from 14.5° to 31.5°. The life cycle from larva to larva occupied 25 days at the optimum temperature, 27°, and 87 days at 16.5° C.

Some crops will grow at this latter temperature and could be raised in infested soil without serious damage. Possibly other crops might do well at a soil temperature of 100° F., which is too high for continued nematode activity. The soil temperature at Tifton, Georgia, averaged below 62° F. during four months of the winter of 1932-33. From May through September it was near the optimum for nematode activity. Under good conditions we should expect eight or even ten generations of nematodes a year in Tifton. Somewhere in Florida we would find the northern limit of continuous activity with at least twelve generations a year possible. The potential increase of population in ten generations is enormous, even considering that only a small percentage of the 300 to 600 eggs produced by one female may hatch and the worms develop and reproduce. Farther north the period of inactivity would increase, until in the northern United States probably not more than one generation would develop each year.

Moisture: Godfrey and Hoshino tested the survival of this nematode at different degrees of dryness. One hundred percent humidity is necessary for survival. At 90 percent humidity larvae were killed in 30 minutes, eggs in egg masses were killed in 9 hours, but 75 percent of the eggs in root galls survived 20 days in this atmosphere. At 50 percent humidity larvae were killed in 4 minutes, egg masses in 2-1/2 hours, eggs in galls in 2 days

However, it is impossible to reduce humidity below 100 percent in the soil interspaces on a large scale. Infested roots dried in the sun for a week or two should be free of this nematode. Roots should always be plowed out of the ground after harvest and allowed to dry before being turned under. Plants such as cotton left standing in the field after picking will produce another generation or two of nematodes to infest the soil.

Brown, in California, obtained a great reduction of nematodes after 1 year of continuous flooding. Free larvae were not found after 4 months but the infestation remained, probably as viable eggs, somewhere between 12 and 23 months. In parts of Florida, where the fields are tiled for drainage and subirrigation, and where artesian water is obtainable, farmers control root-knot by flooding their soil for several weeks at a time. Some believe that alternate flooding and drying of 2 or 3 weeks each is more effective, but there are no experimental data. The ground is cultivated during the dry intervals to promote hatching of eggs. The larvae are stirred to activity by the excess water and soon exhaust their stored food supply. Without available host plants they die of starvation.

Physical and chemical factors: Bessey found that new roots of infested plants transplanted to clay soil remained free of root-knot, and other susceptible plants in the same pot were not attacked. This effect is generally thought to be due to the mechanical difficulty the larvae have in making their way among the finely divided soil particles.

There is possibly a slight reduction in infestation at pH values above 7.6, according to Godfrey and Hagan, but no other differences were found though soils were tested through a pH range from 3.5 to 8.5. Anagnostopoulos on the other hand states that in the soil of the Laboratory of Horticulture in Athens, Greece, a high content of lime and a pH of 7.5 and above is responsible for the absence there of the root-knot nematode.

Food supply: The root-knot nematode is an obligate parasite. Larvae scattered through the soil must come within a few inches of a root tip, or else spend their lives wandering aimlessly through the soil and finally die of starvation.

Just how far a nematode can scent the secretions from a root tip in the soil water is not known, and probably varies with the plant species and with the movement of the soil water. It seems possible also that the physiological nature of the root would affect the nematode, in length of life cycle, and in number and viability of eggs produced. Godfrey and Oliveira found a period of 35 days from inoculation to egg-laying in pineapple roots, compared with 19 days in cowpea roots under identical conditions. There are tentative suggestions in the literature to the effect that nematode resistance depends on the physical nature of the root, but there is little real evidence on this subject.

METHODS OF DETERMINING AND MEASURING INFESTATIONS. Miss Tyler discussed the common method of measuring soil infestation by means of indicator plants, used in cases where it is important to know whether or not a certain soil is infested, and also to determine the results of soil treatments. The roots of crop plants and weeds may give valuable information in the field, but the absence of galls is not always a dependable indication, particularly in plants with fleshy roots. Field samples may be tested in greenhouse pots. Standard conditions for a pot test require a highly susceptible host plant with a rapidly growing, spreading root system and definite gall formation not confused by legume nodules, grown for thirty days, or one generation, under optimum conditions of soil texture, temperature, and moisture, without contamination by nematodes from other sources. To certify land as entirely clean requires repeated, careful, and prolonged tests.

Statistical analyses of field material have been proposed. The percentage of plants infested may give a good indication of the situation in some cases, but not in others, as when there is a low population well distributed through the field.

A question was raised on the survival of nematodes in fallow land, whether for one or two years, and whether in the egg or larval stage. More information is needed on this point.

Dr. Poole reported heavy infestation of tobacco by the root-knot nematode in Cecil clay soil. The collecting of information on the actual distribution of root-knot in various types of clay soil was held desirable.

MEANS OF DISSEMINATION. Dr. G. Steiner. The active migration of larvae in soil is restricted to distances of only a few feet, depending on the character of the soil and other environmental factors. Dissemination over long distances is always passive, mostly through the agency of man. Dissemination in nursery stock is extensive. Seedling plants from the south are shipped in quantities to the north and may carry infestation. Corms, bulbs, tubers, rooted cuttings, and plants of any kind with infested roots are disseminators. Seed potatoes have undoubtedly been the means by which the root-knot nematode invaded important potato areas in Oregon, Washington, Idaho, and Long Island. Some dissemination takes place through the distribution of marketable products such as carrots, salsify, celeriac, Irish potatoes, sweet potatoes, even spinach. Irrigation water run over infested fields and turned back into main ditches may carry nematodes for long distances. Local short-distance dissemination is possible by means of tools and cultivation implements. In hot climates such dissemination is perhaps restricted by rapid drying. Horses and men may carry the nematodes on their feet with adhering soil and parts of infested roots. Cleaner working methods are recommended to improve this situation. Sanitation is especially important in greenhouses for pots, potting bench, etc. Seeds, unless they have come in contact with soil, are not carriers. The wind may, however, carry incompletely dried plant roots with egg masses.

RELATION TO TEMPERATURES IN FLORIDA. Dr. G. R. Townsend described experiments conducted at the Everglades Experiment Station on the rate of development of the nematode in the field as affected by temperature. Bountiful beans were grown in reclaimed peat soil inoculated with galled okra roots. Soil temperatures 3 and 6 inches deep were recorded by thermographs. The length of time required for development from larvae in soil through molting to laying and hatching of eggs (table 1) was determined by frequent dissection of roots for each of ten separate generations, at different seasons during 1934, 1935, and 1936.

Results were analyzed by methods originally used by Miss Tyler. The rate-of-development curve (Fig. 1) shows a base temperature at 14.75° C. This is a mean, not the absolute minimum. By using 12° C. (54° F.) as a base temperature, and calculating hour-Centigrade-degree units above this base, as shown in table 2, the amount of development of the nematodes in a given period could be estimated with reasonable accuracy, and form the basis for the more intelligent application of control measures. An increase of 10° C. in the minimum temperature caused a decrease of at least one-half in the length of life cycle (table 1). At continuous optimum temperatures, sixteen generations a year might be possible. In southern Florida ten or twelve generations might develop in a year if fresh host plants were constantly available.

While rather consistent results were obtained in these studies, they should not be assumed to apply directly to conditions in which other host plants and soil types were involved or where factors not present in this experiment might exert an influence.

TABLE 1. Effect of soil temperature on generation-time of *H. marioni* on beans.

| Generation | Generation-time days | Mean temp. °C. |
|---|---|---|
| 1 | 22 | 27.38 |
| 2 | 36 | 23.47 |
| 3 | 64 | 19.54 |
| 4 | 34 | 25.60 |
| 5 | 24 | 29.48 |
| 6 | 30 | 27.08 |
| 7 | 39 | 22.74 |
| 8 | 77 | 17.56 |
| 9 | 35 | 24.29 |
| 10 | 24 | 26.19 |

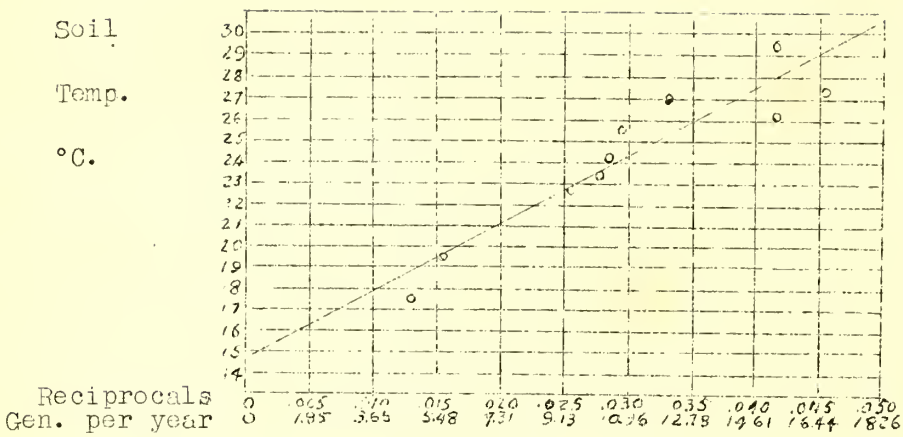


Fig. 1. Rate of development of *H. marioni* on beans as influenced by soil temperature.

TABLE 2. Hour-Centrigrade units above 12° and the stage of development of *H. marioni* on beans.

Number of units from free larvae to:

| Generation | Gall formation | Molting | Egg laying | Hatching |
|---|---|---|---|---|
| 1 | 1465 | 3269 | 6731 | 8123 |
| 2 | 1272 | 4201 | 8352 | 9911 |
| 3 | 2668 | 6010 | 8730 | 11576 |
| 4 | 2951 | ---- | 8920 | 11101 |
| 5 | 1665 | 5467 | 8446 | 10065 |
| 6 | 6178 | ---- | 9293 | 10864 |
| 7 | 1483 | 3865 | 6191 | 10056 |
| 8 | 2275 | ---- | 8202 | 10276 |
| 9 | 2230 | ---- | 9384 | 10324 |
| 10 | 1492 | ---- | 6827 | 8177 |
| Means | 2368 | 4564 | 8108 | 10048 |
| Standard deviation of means | 436 | 456 | 339 | 339 |

Assuming that 100 larvae hatch from one female, the following generation theoretically would be 100 x 100 and so on. The rapid increase possible at optimum temperatures indicates why nematodes "come back" unless control measures are constantly enforced. Experiments on control with chlorpicrin were conducted by Neller in Florida, but except for seed beds this treatment was unprofitable because reinfestation is so rapid.

A discussion of factors responsible for inhibiting indefinite multiplication of the nematodes brought out the suggestions that the food supply and various enemies of the nematodes must both be involved, although what the parasites or controlling organisms may be is as yet unknown for the Florida situation. Dr. Steiner mentioned that, in the case of _Heterodera schachtii_ in sugar beets, the heavy infestation of a root delays hatching of the eggs. A possible explanation is that heavy infestation stops the growth of root tips and thus stops the root-tip secretion which is supposed to stimulate hatching. It was asked whether in southern warm soils where the nematodes increase so rapidly, parasites would not attack them more abundantly, or the nematodes by their numbers create conditions unfavorable to their own growth. Dr. Steiner remarked that on these points no exact data were available, and cited the unexplained fluctuation in the tobacco-rotation plots at Tifton as indicating the presence of possible controlling factors like parasites. Under optimal conditions the larvae could probably stay alive three or four months in the soil without access to host plants.

EXPERIMENTS ON NEMATODE CONTROL IN FLORIDA WITH FERTILIZERS AND CHEMICALS, AND BY CULTURAL METHODS. Prof. J. R. Watson. The most economical control for root-knot on Florida truck farms is to grow an immune cover crop, such as _Crotalaria spectabilis_, during the long rainy summer. Careful cultivation eliminates weed host plants and aerates the soil enough to force all eggs to hatch.

Permanent seed beds demand more prompt treatment. Rotations cannot be practiced because of permanent irrigation systems. In such cases we use sodium cyanide extensively, following the procedure of Dr. Woodworth of the California Station. We dissolve the sodium cyanide in water, apply it as evenly as possible to the surface of the soil, then turn on the irrigation water, usually overhead sprinklers, until the solution is carried down to the depth of a foot or so. Ammonium sulfate in solution is applied immediately after this, certainly the same day, and washed down with a little irrigation water. The amount of ammonium sulfate used is always 50 percent more than the amount of sodium cyanide. The reaction between these two chemicals releases hydrocyanic-acid gas in the soil. The soil must be covered immediately to retain this gas. Balloon cloth is one of the best covers, but building paper, canvas, paraffin-impregnated cloth, or even newspapers have answered the purpose.

Because nematodes are so generally distributed and reinfestation is so prompt, we aim only to reduce the nematode population to a point where profitable crops can be produced during one trucking season. In the ancient sand dunes on the lower east coast of Florida, used for growing pineapples, a dosage as low as 300 pounds of sodium cyanide and 450 pounds of ammonium sulfate per acre is effective. On Norfolk sandy loams more commonly used for trucking, such as most of the soils about Gainesville, 600 pounds of sodium cyanide and 900 pounds of ammonium sulfate usually give commercial control. Materials alone for this dosage cost over $100 per acre. To get complete eradication it is necessary on this type of soil to use 1,000 or 1,200 pounds of sodium cyanide and, as always, 50 percent more of the ammonium sulfate. It takes an even higher dosage to kill Bermuda grass, but soil insects and all small weed seeds are killed by an ordinary fumigation. The soil may be planted within a week or ten days after treatment. We have treated an area as large as two acres in a celery farm.

The response of plants raised on these treated beds is greater than would be accounted for by the excess of ammonium sulfate left in the soil. It seems as if the action of the gas on the soil colloids must be a contributing factor in the surprising fertility of the treated soils. Ammonium sulfate alone helped greatly, probably by supplying the infested plants with an abundant supply of nitrogen, but we did not find sodium cyanide alone satisfactory. Some truckers consider that the fertilizer value of the materials is worth the cost, and they get the nematode control for nothing. We have found this method cheaper than attempting to steam the soil or treat it with hot water, unless the seed bed is permanently piped and a source of steam readily available.

We tried the less expensive calcium cyanide, but we had to use twice the amount to get the same degree of control without the fertilizer value. However, the soil moisture was sufficient to liberate the gas without watering.

Cyanamid gives a less expensive treatment and is now used extensively on truck crops on acreages. Applied in the dry form it seems to have almost no power of penetration, so it must be very thoroughly mixed with the soil. One-half of the dosage, namely 500 pounds per acre, is added to the top of the soil, which is then thoroughly disked. The land is then deeply plowed and the other 500 pounds added to the top of the plowed soil, which is again thoroughly disked. This procedure has usually given us fair commercial control of nematodes, though in some cases we have also added cyanamid to the bottom of the furrows, either by hand or by means of a distributor fastened to the plow. It is not safe to plant the land within three or four weeks after application of the cyanamid, depending somewhat on the rainfall during this period. In fact, an application of old, caked cyanamid once, during the war, sterilized an acre so thoroughly that the owner could raise nothing on the land for a year.

We found that an application of sulfur as low as 300 pounds per acre decidedly reduced the number of nematodes in the soil, but never could we get complete eradication, though we went as high as two tons per acre. Even 500 pounds per acre made the soil too acid.

Perennial plants and trees present a particularly difficult problem in nematode control. Several years ago, in cooperation with the Horticulturist of the L. and N. Railroad, we tried the effect of calcium cyanide on peach trees. An application of half a ton per acre injured the trees but no injurious effects were noticed with dosages of 750 pounds or less, nor from half a ton if given in two applications three or four months apart. Trees given from 500 to 750 pounds showed a marked improvement in color and made better growth than the checks, but the results hardly seemed to justify the expense.

After two years the trees were dug up. The trees which had received 500 or more pounds of cyanamid per acre per year showed an appreciably smaller number of galls on their roots.

The question was raised as to whether the improvements in plants treated with cyanamid might not be due to mere fertilizer effect. However, comparable amounts of nitrogen were employed on check plots and it was found that the sodium cyanide-ammonium sulfate combination gave distincely improved control of the nematode. It did not have any permanent effect on nut grass. The question arose as to whether nut grass, Cyperus rotundus, is a host of the root-knot nematode. Dr. Poole reported having seen nematode galls on it.

Dr. Poole reported promising results with cyanamid, especially on poor soil. He obtained great reduction of nematodes in 1935 with 1,000 pounds per acre and intends to test 2,000 pounds per acre.

Prof. Hume emphasized the importance of Prof. Watson's work with Crotalaria spectabilis. He cited the work at the North Florida station, where in breeding tobacco for resistance to black shank it became necessary to repeat tobacco on the same soil year after year. In 1934 nematodes became so abundant that the crop could not be grown there. In July the ground was planted to Crotalaria spectabilis in rows and no other plant was allowed to grow: similarly subsequent years. Since that time there has been no trouble from nematodes with the experiments on these plots. The soil is of a clayey type with sandy loam on top, there being not enough clay to interfere with the nematodes.

CHEMICAL CONTROL STUDIES. Mr. A. L. Taylor. The ideal chemical was defined as one effective against all stages of the nematode but harmless to the plants, easily obtainable and cheap, not harmful to man or animals, and leaving no harmful residues in the soil. No material now known satisfies all these desired conditions.

Chlorpicrin, applied under climatic and other conditions prevalent at Tifton, Georgia, during the season of 1936, at 200 or 400 pounds per acre ($1.00 per pound), was found 100 percent effective as compared with the controls; at 100 pounds, 93.5 percent effective; at 50 pounds, 82.3 percent effective. Carbon disulfide at 1,000 and 2,000 pounds (10 cents per pound) was 97.8 percent effective; at 500 pounds, 88.7 percent; at 250 pounds, 36.2 percent. Cyanamid applied in furrows up to 2,000 pounds per acre gave no observable control. (Prof. Watson called attention to his experience indicating the need for thorough mixing of this chemical with the soil). Ammonium thiocyanate (18 cents per pound) applied dry to damp soil up to 1,600 pounds per acre gave no control. However, when dissolved in water, even 800 pounds per acre made it impossible to grow any plants throughout the rest of the season.

Carbon disulfide, 68 percent emulsion, mixed with water and applied by hose to the soil at the rate of one gallon to 200 square feet had no effect, but at the rate of 1 gallon to 100 square feet proved 96.6 percent effective and at 1 gallon to 50 square feet, 100 percent effective. Formaldehyde (37 percent) up to 1,088 gallons per acre ($1.00 per gallon) was not effective. Prof. Hume remarked that Dr. Neller had designed an applicator for chlorpicrin and carbon disulfide, which are poisonous materials and cannot be used where perennials are involved.

Dr. Plakidas reported an experiment with cyanamid applied by Prof. Watson's method in very sandy soil in July, at the rate of 1,200 pounds per acre. Cucumbers planted five weeks later on the treated soil made a good start and produced a large crop. Their roots showed 50 percent fewer galls than the checks.

Miss Tyler pointed out the discrepancies in the results of various test and suggested that the soil type might account for some differences, since clay absorbs and holds cyanide and other materials to an extravagant extent. She called attention to the excessive rate at which carbon disulfide emulsion was used in Mr. Taylor's experiment, as compared with his dosages of undiluted carbon disulfide. Another extravagant form of carbon disulfide is potassium xanthate. Formaldehyde in dust form is similarly dissipated. Cyanamid is primarily a fertilizer rather than a fumigant.

Chlorpicrin is more effective than any chemical that was used for nematode control ten years ago. There is an important field for study on the application of this sort of material with subsoil machines, and on special covers for confining volatile fumigants. There was some discussion on the value of 90 percent control, if 100 percent control in the field by any practicable method should prove too much to hope for.

GENERAL DISCUSSION ON CROP ROTATION WITH RESISTANT PLANTS. Prof. Watson, reporting on tests for resistance at Gainesville, Florida, said that only one case of root-knot infestation had been found on <u>Crotalaria striata</u> and none on other species of <u>Crotalaria</u>.

The problem of nematodes on tree roots was discussed. Since nematodes will come in from neighboring land, this can be solved only by the development of resistant stocks. However, Mr. Barss suggested the possibility of developing populations of soil organisms in orchards antibiotic to nematodes - a method used with some apparent success against Texas root rot in Arizona. Dr. Steiner suggested that if the perennial were started with clean roots, any nematodes subsequently introduced might be controlled by a very attractive trap crop, requiring, however, the closest attention.

Mr. H. W. Barre brought up the question of studying bare fallow closely enough to find the conditions under which a soil could be freed from infestation, and to find the minimum time. Mr. C. J. King reported that at Sacaton, Arizona, after two years of fallow and summer tillage of nematode-infested land only a few islands of galled plants occurred in a block of susceptible cotton. In three years the elimination of the nematodes appeared complete. This treatment had so improved the soil as to double the crop. The soil was turned one foot deep three times during the summer, and between rains a disk harrow was used. The soil temperatures averaged 80 to 86° F., and even 92° in the top six inches.

Referring to fallowing methods, Prof. Watson indicated that this method gave commercial control in four months in muck soil, but ruined the fertility of sandy soil. Dr. Townsend reported that some truckers who had been using fallow methods on muck land had gotten bad soil effects and given up the method.

Mr. King reported that ammonium carbonate, applied in large quantities, ruined the soil for one year and gave only partial control. He reported that cotton varieties differ greatly in susceptibility. Egyptian cottons (Gossypium barbadense) are badly injured by root-knot. Acala cotton (American Upland type) now replaces the former with yields of 2,000 pounds of seed cotton per acre. Other Egyptian cottons have been tried, and hybrids between Sako and American Upland cotton have been found fairly resistant. The first-generation hybrids proved very resistant and vigorous, but plants of the second generation revert to type. By rotation with grain and sorghum in the summer fair control has been obtained for subsequent crops, but it is the hope in Arizona to eradicate the nematode by fallowing methods.

DEVELOPMENT OF ROOT-KNOT-RESISTANT VARIETIES OF CROP PLANTS. Mr. K. C. Barrons. Dr. Isbell of Alabama has developed a resistant bean originating from seed collected from Alabama farmers. Two selections, Alabama No. 1 and No. 2, proved resistant for practical purposes, with only a few small galls. Desirable commercial types with resistance equal to Alabama No. 1 and No. 2 are being bred from these and will be ready for distribution in about two years.

Orton's Iron cowpea is more resistant than Brabham and Victory cowpeas, bred from Iron. A strain of Conch cowpea tested in Alabama seems almost immune in the adult stage. Prof. Watson, however, thinks some strains may be susceptible. The resistance factor in Iron cowpea has been found dominant, but not inheritable by simple Mendelian segregation. At Alabama an effort is being made to develop resistant edible cowpeas through crossing Iron and Conch.

Hopi 155 is probably the best "butter" bean for the South to grow because of its long season of bearing and its resistance to drouth. Mr. King reported that he had collected many colored limas from the Hopi country, some much more resistant than Mackie's Hopi 155, but the trade does not want these mottled limas. Mr. Barrons quoted observations on resistance in cotton and also in tobacco and soybeans. Irish potatoes so far show no freedom from nematodes but some differences in susceptibility. Among sweet potatoes Red Jersey and other varieties show some resistance. There is a good chance for holding resistance once it is found in sweet potatoes because they are vegetatively propagated. Tufts and Day report some resistant peach, plum, cherry, and almond varieties. There is a possibility of budding or grafting susceptible species or varieties on to resistant stocks, and a single source of resistant seed is sufficient, without segregating the genetic factors. Old trees surviving in infested areas should be sought for their possible resistance.

At Alabama a search is being made for resistance in the tomato. Variations in susceptibility have been found. Perhaps by crossing two somewhat resistant varieties offspring more resistant than either parent may be obtained by transgressive segregation. To illustrate the possibilities of grafting, Mr. Barrons remarked that Dr. Isbell has grown tomatoes on roots of jimson weed (Datura stramonium). His experiment was in connection with tomato mosaic control. If, however, jimson week should prove tolerant of nematode infestation, as appears possible in spite of abundant galls, such a graft would be of more than theoretical interest.

Seedling tests for resistance now used with beans, lima beans, and cowpeas help to speed up the breeding work. By inoculating the soil in the greenhouse bench with affected tomato roots, bad infestations were obtainable twenty days after planting. The method used for classifying infestation in homozygous strains was to take a sample of ten plants from each of the different lots and rate them by inspection as to severity of attack, on a scale of from 1 to 5. Gall counts were not worth while. Good correlations were found between field and greenhouse performance in beans and cowpeas, but Hopi limas, which have adult plant resistance in the field, showed little resistance in the twenty-day greenhouse test. The question of seedling stage susceptibility in relation to adult plant resistance should be checked and tested out.

Mr. Taylor reported his experience with Iron and Brabham cowpeas at Tifton. One field of Iron was found about 50 percent infested. Brabham was found 10 to 15 percent infested. It was conceded that the Iron seed may have been rather badly mixed and that the same was true to a lesser extent for Brabham. The Iron cowpea has been used for thirty-five years. Such crops are valueless in rotations for nematode control. Dr. Edson remarked that, unless provision is made for continuous selection, considerable variation might be expected to develop in any resistant line. Mr. Taylor reported that Mackie in California is trying to segregate resistant lines of the Iron cowpea type.

The question was raised whether there is a difference in the time of root-knot nematode attack on different hosts. Godfrey was cited as reporting a difference in the rate of development on pineapple and on cowpea, a more favorable host. Mr. Taylor reported finding a difference in time of attack by the nematode on adjacent rows of beans of different varieties.

Mr. Kime referred to his experience with cowpeas in North Carolina, where Iron and Brabham have shown more tolerance than other varieties. Nematode resistance seems to be related to Fusarium-wilt resistance. One Iron strain of a later and more vining type, picked up near Wilson, was found highly resistant to both. Dr. Poole suggested that all interested should obtain samples of this promising strain. Mr. Barrons suggested the use of artificial methods of inoculating field soil, to obtain an infestation many times greater than otherwise. Vetch planted in September is a good source of soil-infesting material in the spring, while tomatoes are excellent for a summer supply.

ELIMINATION OF ROOT-KNOT INFESTATION FROM PLANTS. Dr. Steiner. The one successful therapeutic treatment of plants so far devised is to soak the roots for a specified time in hot water maintained at a specified temperature, the standard treatment being one-half hour at 118° F. There is need for careful study on the tolerance of various tubers, corms, and bulbs, and of roots, especially nursery stock (roses, young trees, etc.). The tuberose will stand 126° F. and do better than if not treated. The fancy-leaved caladium illustrates one of the problems: only properly ripened tubers will stand the temperature necessary for controlling the nematode. Peony roots stand the treatment very well. Plants in general tolerate shorter treatments at higher temperatures better than the more extended treatments at lower temperatures.

No other therapeutic methods or nematocides have been developed for the treatment of infested plants. Occasionally trimming is resorted to for removing galls from propagating stock, or cuttings from above the soil are used to avoid infestation. The question was raised as to whether x-rays had been tried out. Dr. Steiner reported that various types of x-rays, infra-red, ultra-violet rays, etc. had been tried without any evidence of beneficial effect unless the temperature rose to the point where it affected the nematodes.

SPECIAL DISCUSSION OF NEMATODE HOSTS. Prof. H. Harold Hume. On invitation to discuss any phase of the nematode problem which he might consider helpful, Prof. Hume began his discussion by taking up the question of nematode hosts, calling attention to the fact that in the present host index we have positive records of attack but no comparable records of resistance in plants. In ornamental gardening and landscaping, it would be desirable to use root-knot resistant types of shrubs rather than susceptible types. In his experience some plants, such as Pittosporium tobira, which originally appeared tolerant, have shown injury after a period of years. All azaleas, both American and Oriental, are free from nematodes, or at least able to persist year after year where other plants succumb to nematodes. All camellias, including C. japonica and C. sasanqua, appear to be free from attack. Prof. Hume reported never having seen harmful infestation on conifers, naming the Taxaceae and the genera Pinus, Chamaecyparis, and Juniperus. He stated that he had never seen a rose that was not attacked but that he had observed much variation in the extent of damage. Madame Plantier of the China rose group, often used in the South as a stock, a very old type, was not badly affected. Marianna plums had never been seen infested by nematodes. Other plums and the Chinese group of pears had never been found affected sufficiently to be damaged in growth. The roots of the native persimmon are quite free from damage. Many of the Oriental persimmons may probably also be resistant. Of the Ligustrums, five species of which are reported as hosts, only L. quihoui has been free from attack, and is useful as an understock for other species of privet. L. ovalifolium and L. amurense are among the most susceptible hosts for white fly and also for root-knot nematode. There is a correlation in susceptibility of a species to various pests. No species of oaks have been seen affected nor has Magnolia grandiflora. Deciduous magnolia may be grafted satisfactorily upon M. grandiflora. Although the mulberry is infested it does not suffer much injury.

Prof. Hume voiced the opinion that uncontaminated natural soil is free from root-knot. Peach seedlings which are seeded in cleared virgin land may be grown for one or two years before nematodes appear, then the nurserymen must rotate. A method used to advantage for clearing heavily infested nursery land of nematodes is to plant it with pine trees set near enough together to shade the soil, keep green weeds out, and cover the ground densely with needles. Within six or seven years, possibly less, the land will be free of nematodes. In small gardens the grower can get plants well started by excavating the ground and putting in uninfested soil.

Prof. Hume described the nematode problem as something of an orphan child, more or less neglected by plant pathologists and entomologists. The heart of the problem of permanent control lies in the resistance of plants. All should watch for such resistance regardless of the value of the particular plants, since resistance found anywhere might be combined with desirable qualities.

Dr. Steiner mentioned a supposedly resistant species of gardenia. He told of a $100,000 loss to one cyclamen grower because a very few galls can prevent the blooming of this plant.

Mr. Barss asked if it would be possible to arrange for systematic testing for resistance of plant species and varieties, perhaps through co-operative effort. Dr. Poole suggested that a committee might handle this for the benefit of all.

THE ROOT-KNOT NEMATODE IN RELATION TO OTHER PLANT PARASITES. The question arose as to what other plant pathogens may be aided by nematode attack. Dr. Arndt studied sore shin of cotton in South Carolina in relation to several nematodes other than root-knot, but the results did not appear conclusive. There is some indication that fungi may, under certain circumstances, enter the lesions made by nematodes. Rhabditis is known to carry a bacterial disease in mushroom beds. Dr. Poole mentioned that the blistering of leaves of tobacco plants affected with root-knot was magnified before harvesting by the decay of the galls. Dr. Moore reported the complete destruction of ten acres of Marglobe tomatoes apparently as the result of wilt started by nematodes. Mr. Taylor asked for definite evidence that the root-knot nematode and the Fusarium wilt of cotton work together. Dr. Armstrong reported that at South Carolina one test was run in which they got more wilt in pots with the root-knot nematode than without it. The test will be repeated. Dr. Miles reported that, although no tests had been conducted at the Mississippi Station for the specific purpose, the wilt-resistant varieties did not stand up against wilt so well when infested with root-knot as they did without root-knot. Dr. Barker said that Sea Island and Pima cotton usually hold resistance to wilt but are extremely susceptible to root-knot. Dr. Weber reported some tests in Florida where wilt-resistant varieties of tomato did not appear to lose their resistance in the presence of nematodes.

Mr. Barss suggested experimenting with various chemical ions or chemical combinations that might be absorbed by plants either through roots or foliage and render the plant inhospitable to nematodes. The nature of resistance also might be studied by spraying with extracts from resistant plants. Dr. Steiner reported that in work already done arsenicals had proved very toxic to the nematodes while nicotine did not affect them.

## SOME OBJECTIVES IN THE ROOT-KNOT NEMATODE SURVEY

ROOT-KNOT NEMATODE SURVEY. Dr. H. A. Edson. In general, the distribution and seriousness of the root-knot nematode are known. The need is for records which will provide information useful to research workers. Dr. Edson presented three different outlines for data cards, prepared by Mr. Paul R. Miller of the Federal Plant Disease Survey. First, an outline for a general survey of root-knot and other nematodes; second, an outline for the root-knot nematode alone; and third, a simplified system of records on a smaller card, providing space on the back for any specific information of an ecological nature which might be useful in explaining the behavior of the disease.

Mr. Barss suggested collecting the authoritative information now available in the different states on the distribution of the nematode and the soil types and crops on which it is known authentically to occur, and sending this information to the Plant Disease Survey as a foundation on which to build a more complete picture as the card-system records are brought in from year to year. Dr. Armstrong insisted that there was indeed need for more study in the different states and Dr. Edson reported that the Plant Disease Survey had no information of real value as to the actual distribution of the root-knot nematode within the different states. Dr. Miles stated that there were records collected since 1920 by the State Plant Board of Mississippi, which he would try to get for the benefit of the nematode survey and for possible additions to the host list. Mr. King reported that the Soil Conservation Service has the opportunity to collect information on degrees of susceptibility of different types of plants in its nurseries. Dr. Winters reported that the North Carolina station is making a map to show the distribution of the root-knot nematode in the State. Dr. Edson reported that the Plant Disease Survey was in a position to reproduce such maps and would like to have the North Carolina map when completed.

Mr. Barrons stated that there would be wide use among plant breeders and others for a list of resistant species in all types of crops, with records on the degree of susceptibility of varieties within susceptible species.

SUGGESTED LINES FOR INVESTIGATION. Prof. Hume formulated two objectives for the group: (1) To define the place that complete eradication may play under particular circumstances, as distinguished from partial control under open field conditions in the South where eradication is not an important objective, since any land there will become infested in 2 years of ordinary handling; (2) to collect more definite information on tolerance in plants, a quality which deserves more respect.

Dr. Weber pointed out that in collecting information on variations in resistance the records should be so standardized as to permit proper interpretation. Dr. Taubenhaus argued for standard methods of inoculation. Mr. Barss recommended that a competent committee work on the question of how to manage tests and surveys so that the data on severity or susceptibility might be recorded on a standard basis. It was asked whether the Plant Disease Survey might not collect information on relative resistance or susceptibility of different host plants, and Dr. Edson indicated that he could send out an appeal for such information in the Plant Disease Reporter.

Dr. Steiner asked whether a published survey might not bring difficulties and cause trouble for states furnishing planting stock or propagating materials to other sections of the country. Nurseries, for example, with nematode-free soil would profit by information on infestations in other nurseries. Dr. Edson remarked that this was a familiar problem. The policy of not publishing anonymous statements in the Plant Disease Reporter protects both author and editor and has stimulated correspondence. Information regarding the occurrence of plant diseases may be sent to the Plant Disease Survey in confidence and not for publication. The file of unpublished information is available to research workers. There is some deliberate suppression of information due (1) to fear on the part of commercial interests and (2) to the fear of quarantine regulations, especially of state quarantines. Taking a wide view, the best course would seem to be to make all information immediately available.

Dr. Taubenhaus summarized some of the most promising and important lines for further study as follows:

1. Survey. Each worker might profitably carry out a complete survey in his own state, classifying the information on hosts affected as was done for root rot in Texas Bulletin No. 527, where the ratings were based on 20 years' experience.

2. Soil conditions affecting the root-knot nematode. Experience has shown no nematodes in the highly calcareous Houston soils in the field, though they are present in impermeable Lufkin clay. However, nematodes were found in greenhouses using the Houston soil. Here Dr. Steiner stated the belief that oxygen was needed by the root-knot nematode in the soil, but was less important to saprophytic nematodes. Dr. Taubenhaus spoke of the importance of the oxygen ratio, and also of $CO_2$ and other soil gasses.

3. Conditions for control experiments. Results of soil treatments vary from year to year and from state to state. It would be desirable to lay out plats with barriers to prevent reinfestation from outside. Sulfur boards and sulfur bricks make a complete barrier.

4. Soil sterilization. In Texas it is intended to continue work with sulfuric acid, using the unlimited supplies offered by the sulfur companies for experimental work. Dr. Taubenhaus stated that he would like to be given the assignment of studying soil sterilization and would like to have the cooperation of others, for whom he could arrange for the necessary supplies of sulfuric acid.

HOW TO INCREASE EFFECTIVENESS OF ATTACK ON THE PROBLEM. Mr. Barre recommended (1) the publication in mimeographed form of the information assembled at the conference for the benefit of those who could not be present;

(2) a type of organization with an informal understanding whereby certain individuals and institutions might be responsible for certain parts of the program. Those doing fundamental research would have to lead and help others to initiate work along similar lines, since it is important to check results and repeat with different crops and different conditions; (3) getting together for discussion of progress and outlook as has been done in this conference, as a most important aid to progress.

Prof. Hume suggested that a committee might project the entire field, make a list of the separate things that may be done, and then divide this work among those interested in the particular problems. Some such program would insure the relation of each phase to the whole.

The question was raised whether the Office of Foreign Plant Introduction or some other office of the U. S. Department of Agriculture might not have a nematode plot in which samples of tropical plants could be tested for their resistance to root-knot. Valuable materials might be revealed which would otherwise escape attention. It would be difficult to put such a plan into operation with all plants, since many of them are discarded, but material that shows any value should be tested. The group could well call this matter to the attention of various agencies; it could also emphasize the need for purifying Iron cowpea and breeding other forage crops for resistance to the root-knot nematode. Prof. Hume mentioned that there is much valuable plant material hidden away in our own country, and recommended exploratory work with native plants.

ORGANIZATION. A general discussion on organization to carry on future work was entered into. The complexities of the situation were brought out. In the case of the root-knot nematode, Mr. Barre called attention to the fact that persons working intensively on various phases of the problem sere scattered in such different fields as plant pathology, entomology, agronomy, horticulture, and plant breeding. It was suggested that it would require someone of experience to find a way to bring all these diverse interests together. Dr. Steiner indicated that he felt it very important that the organization should not be confined to nematologists but that it include all those interested in the root-knot problem from the standpoint of plant breeding as well as of pathology.

Decisions of the conference and organization for further activities are reported at the beginning of these proceedings.

# DISEASES OF PLANTS IN THE UNITED STATES IN 1936

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# INTRODUCTION

The most noticeable fact regarding the incidence of plant diseases in 1936, as indicated by the reports on which this summary is based, is the contrast to their development in the preceding year. The reason for this contrast is clearly evident in the weather maps and graphs, Figures 1 to 20 in this summary, and in the monthly weather discussions in Volume 20 of the Reporter. In 1936, the interior of the country, from the Appalachians to the Rockies, suffered what was characterized as "one of the most disastrous crop seasons in the history of the interior United States" (P.D.R. 20: 269), owing to a drought that was "measurably more severe than any other of record in the climatological history of the country". (P.D.R. 20: 246). The extraordinarily high temperatures coincident with the drought burned up the crops and caused such destruction that even where diseases were not themselves inhibited in development they were not a factor in production.

Of the individual plant disease events listed in this summary, probably the most outstanding are the long-expected arrival of blister rust in California and the collection for the first time east of the Mississippi, except for one isolated instance, of the sugar-beet leaf hopper in southern Illinois in association with diseased horseradish showing symptoms very suggestive of curly top. Others that may be mentioned are the discovery of Phymatotrichum root rot in southeastern Nevada adjacent to affected areas in southwestern Utah and the spread of tobacco downy mildew to Kentucky, both of which were to be expected, and the sudden and surprising outbreak of bean rust in several States.

Details have been given concerning all of these and many other occurrences, only very briefly summarized here, in Volumes 20 and 21 of the Reporter. The following Supplements should also be consulted in connection with this summary: 99--"Some aspects of the plant disease eradication and control work of the Bureau of Entomology and Plant Quarantine", by various members of that Bureau; 100--the crop loss estimates for 1936; and 101--"Fruit and vegetable diseases on the Chicago market in 1936", by G. B. Ramsey of the Division of Fruit and Vegetable Crops and Diseases.

As heretofore, this summary is based only on reports to the Survey and makes no attempt to review the literature.

The Survey wishes again to thank all those whose reports and criticism have made the summary possible, including its collaborators, many unofficial contributors, and various members of the Bureau of Plant Industry.

TEMPERATURE

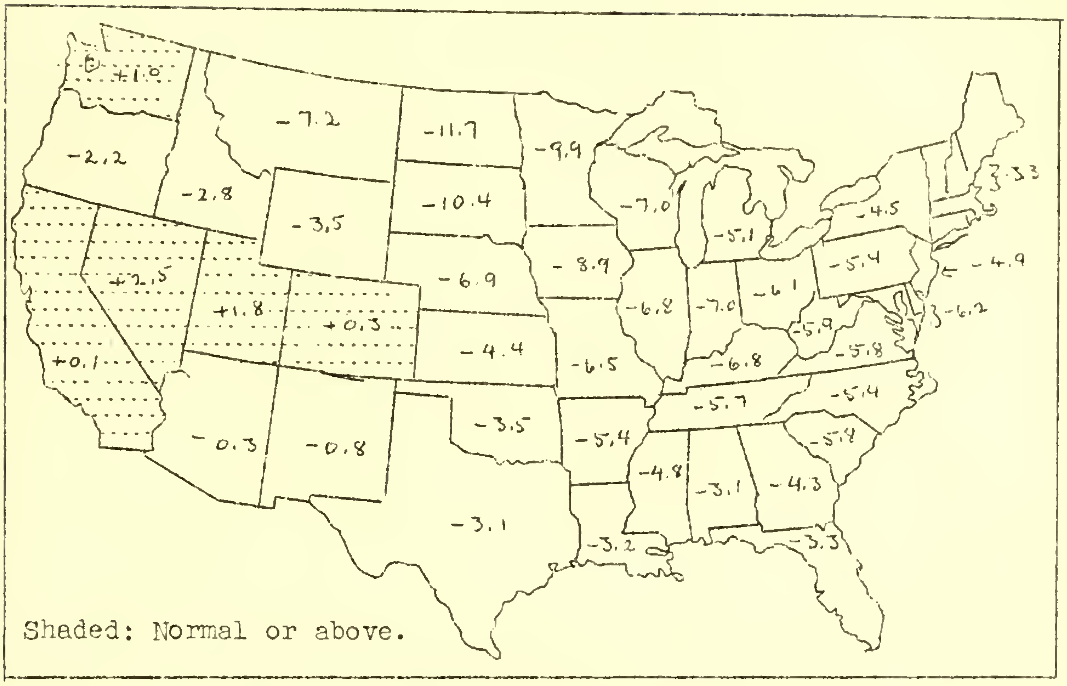


Fig. 1. Departure from the normal temperature for the winter, December 1935 to February 1936, inclusive.

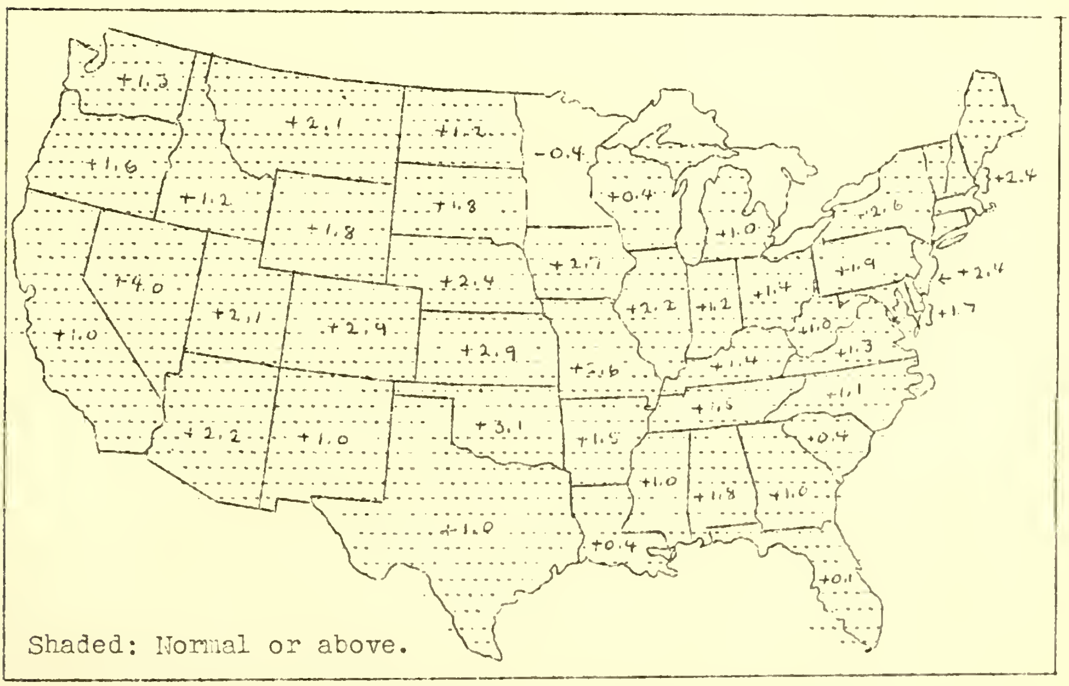


Fig. 2. Departure from the normal temperature for the spring, 1936, March to May, inclusive.

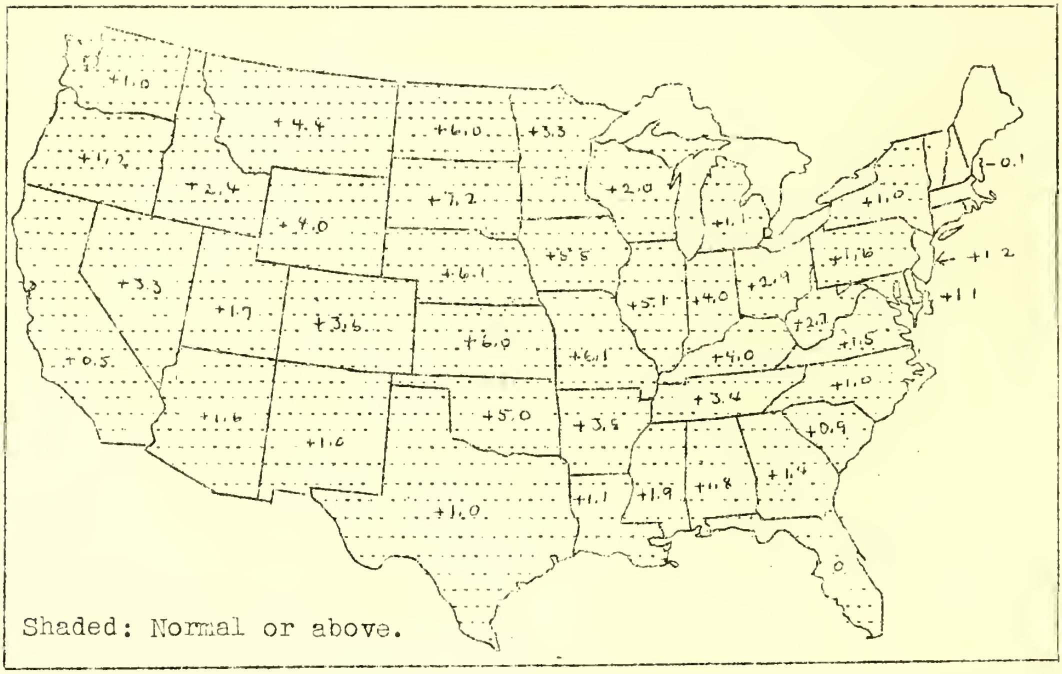


Fig. 3. Departure from the normal temperature for the summer, 1936, June to August, inclusive.

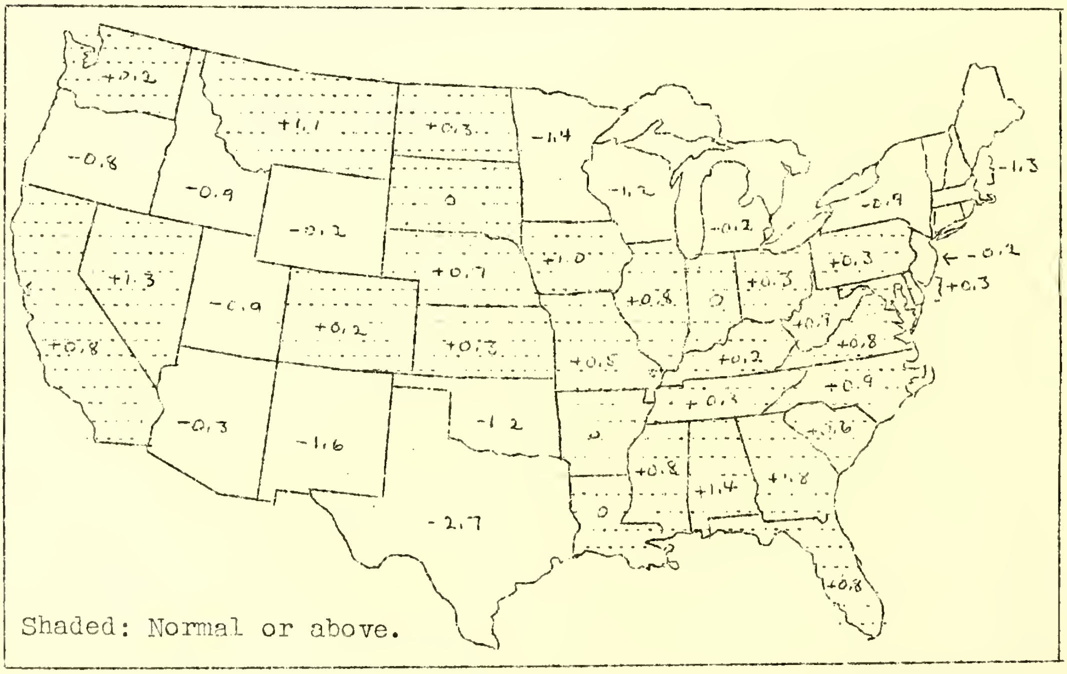


Fig. 4. Departure from the normal temperature for the autumn of 1936, September to November, inclusive.

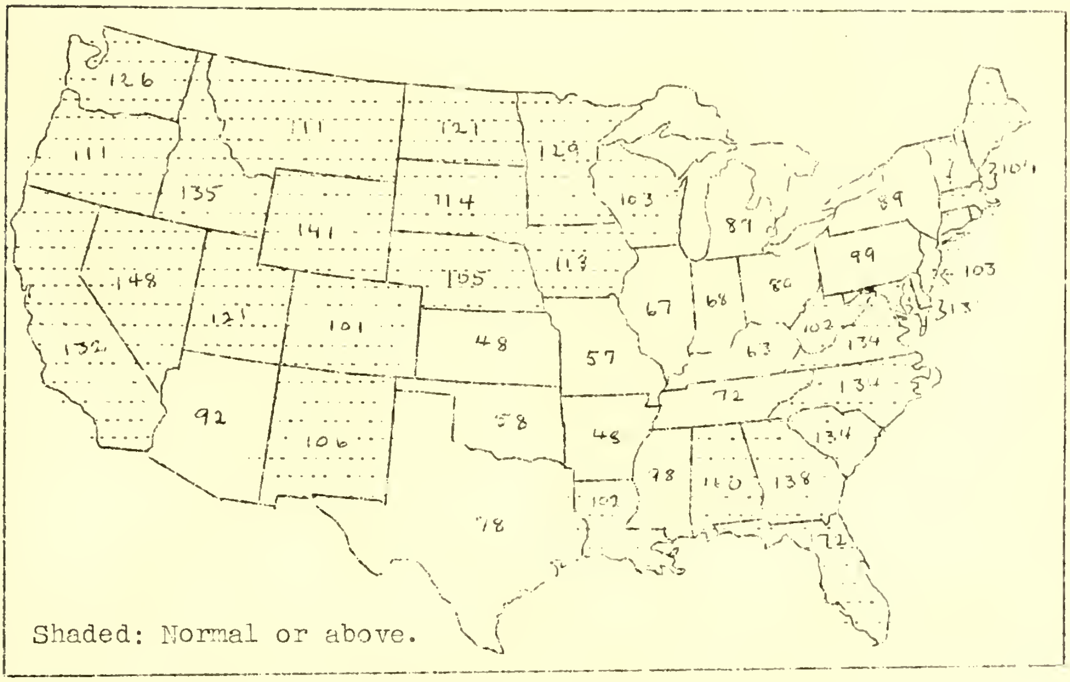


Fig. 5. Percentage of normal precipitation for the winter, December 1935 to February 1936, inclusive.

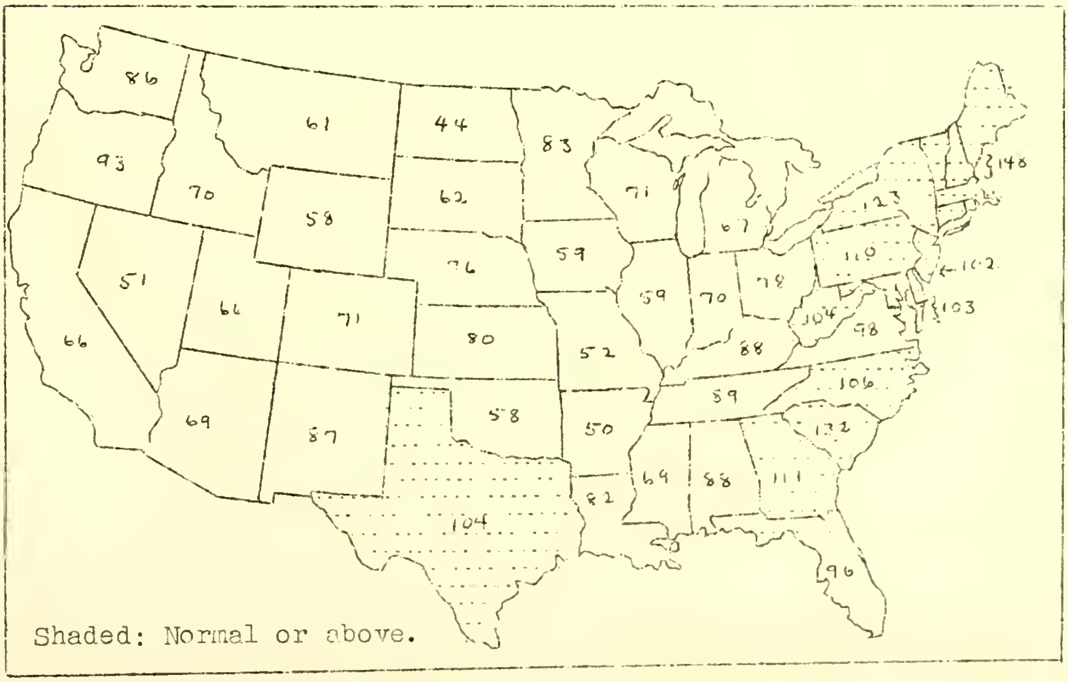


Fig. 6. Percentage of normal precipitation for the spring, March to May, 1936, inclusive.

# PRECIPITATION

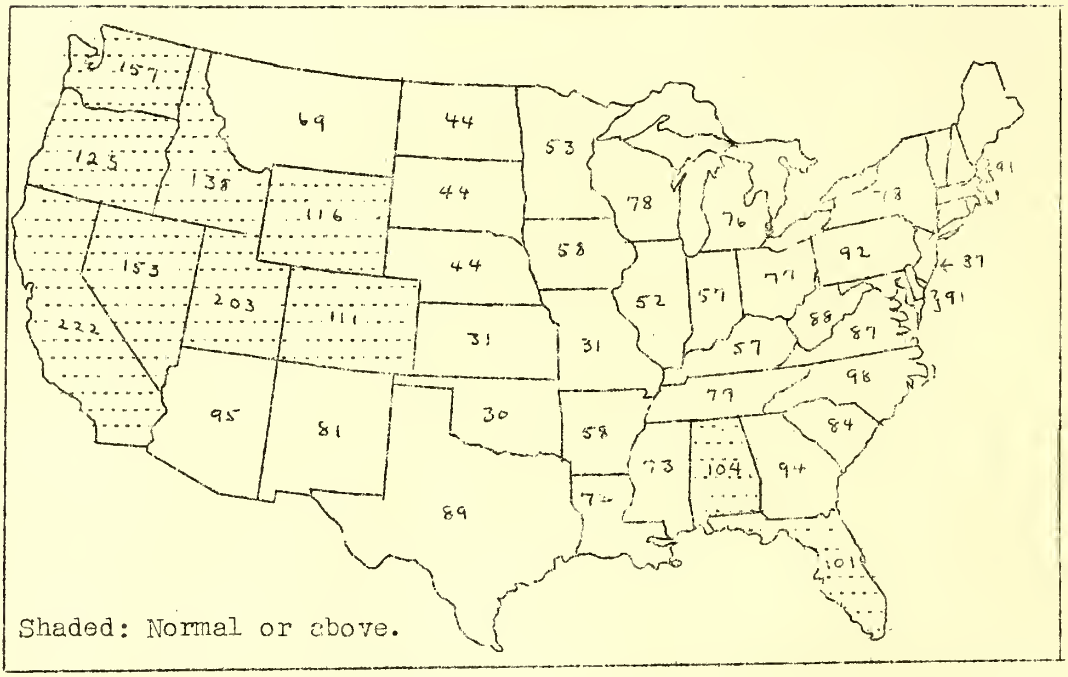


Fig. 7. Percentage of normal precipitation for the summer, June to August, 1936, inclusive.

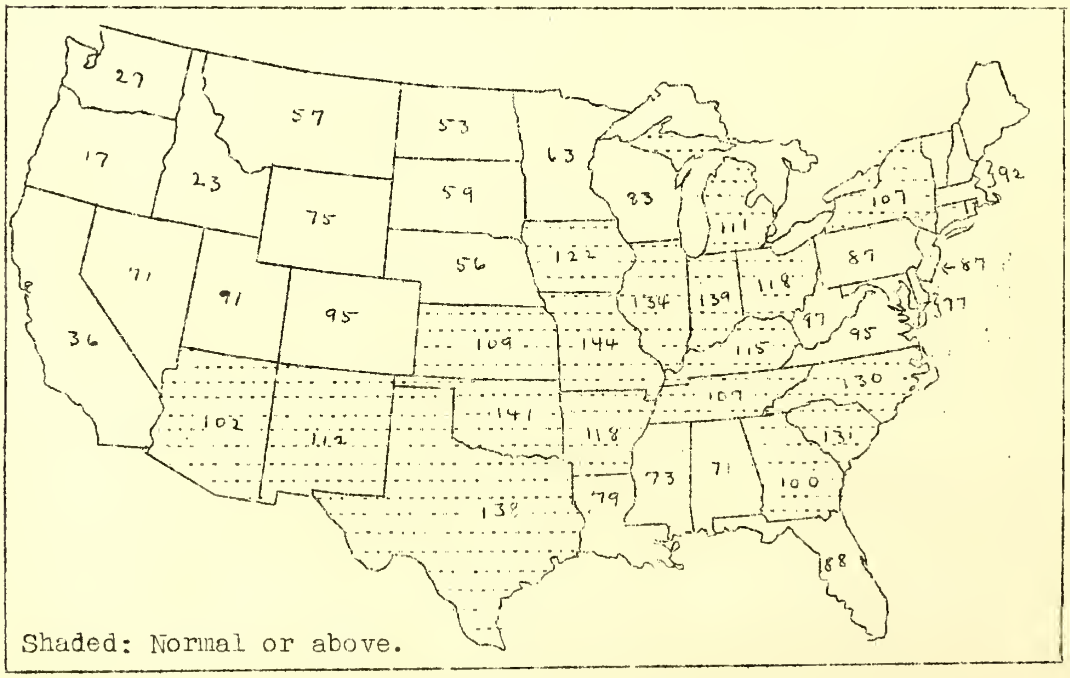


Fig. 8. Percentage of normal precipitation for the autumn, September to November, 1936, inclusive.

HARRISBURG, PENNSYLVANIA

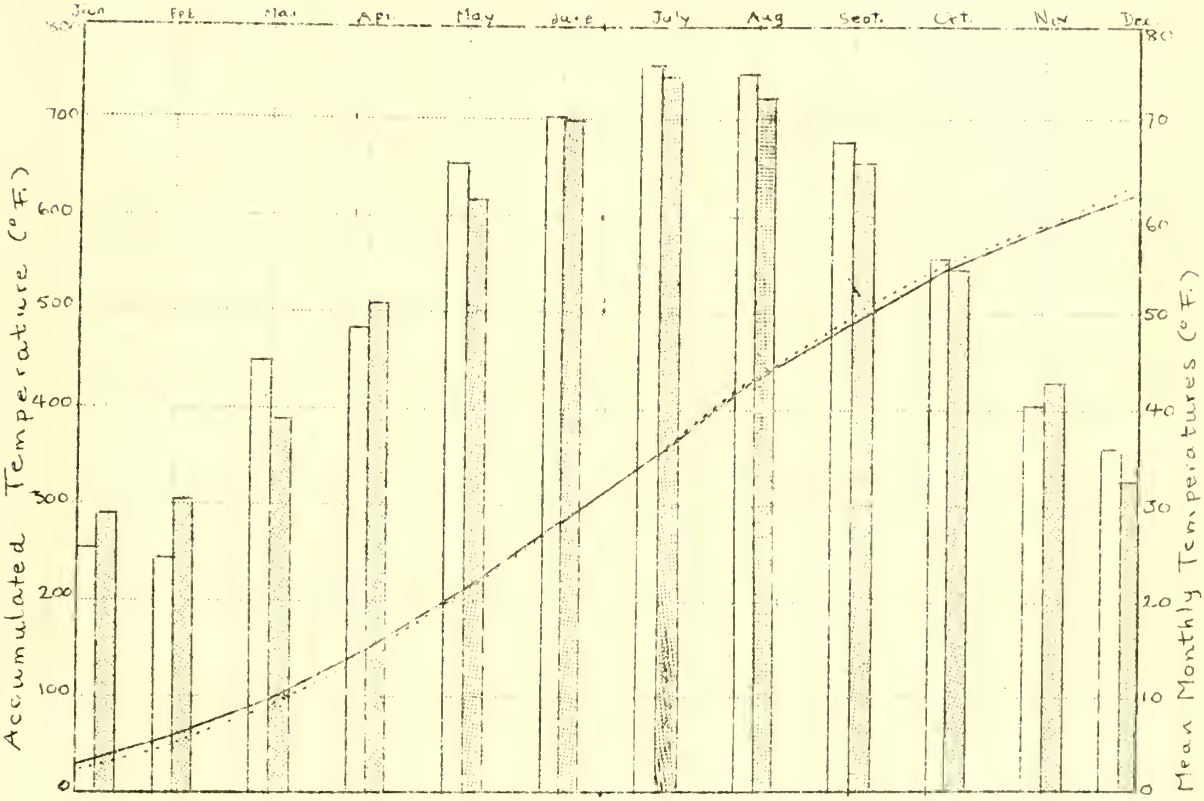


Fig. 9. Accumulated temperature in degrees F. at Harrisburg, Pennsylvania for the year 1936 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

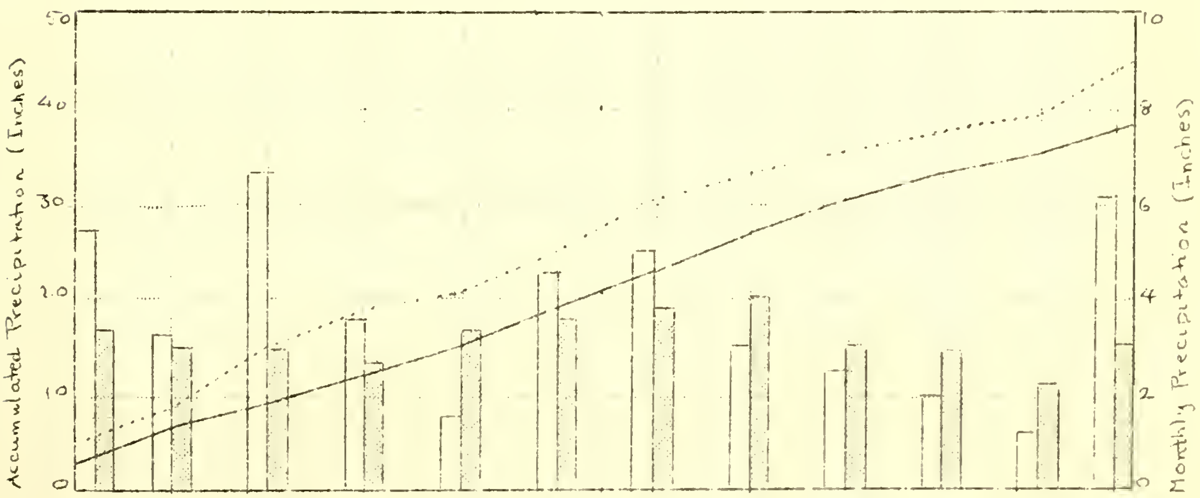


Fig. 10. Accumulated precipitation in inches at Harrisburg, Pennsylvania for the year 1936 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

ATLANTA, GEORGIA

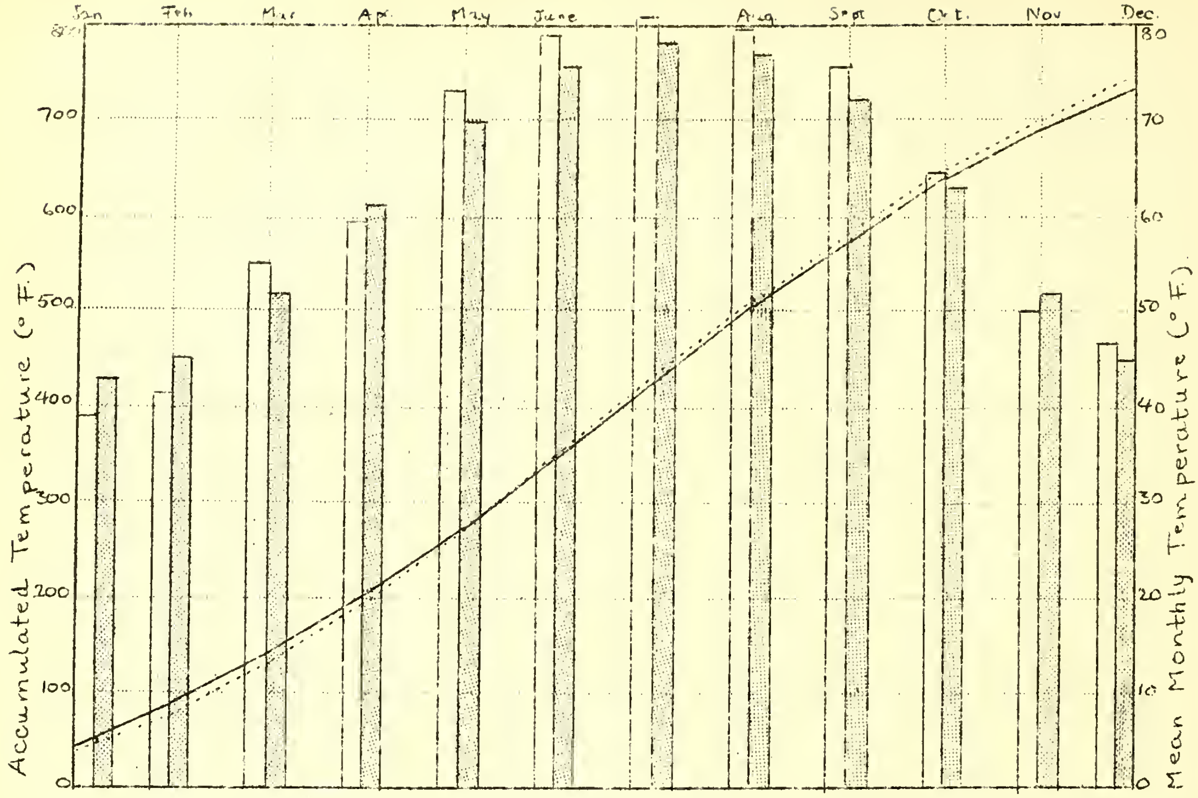


Fig. 11. Accumulated temperature in degrees F. at Atlanta, Georgia for the year 1936 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

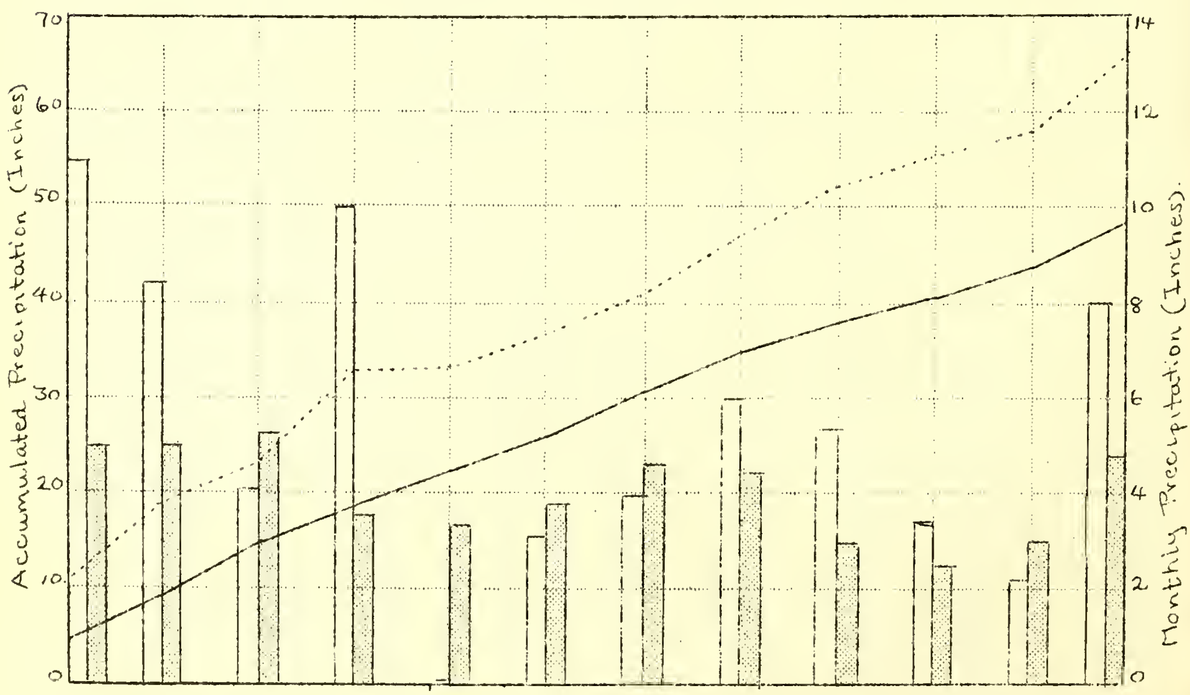


Fig. 12. Accumulated precipitation in inches at Atlanta, Georgia for the year 1936 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

BISMARCK, NORTH DAKOTA

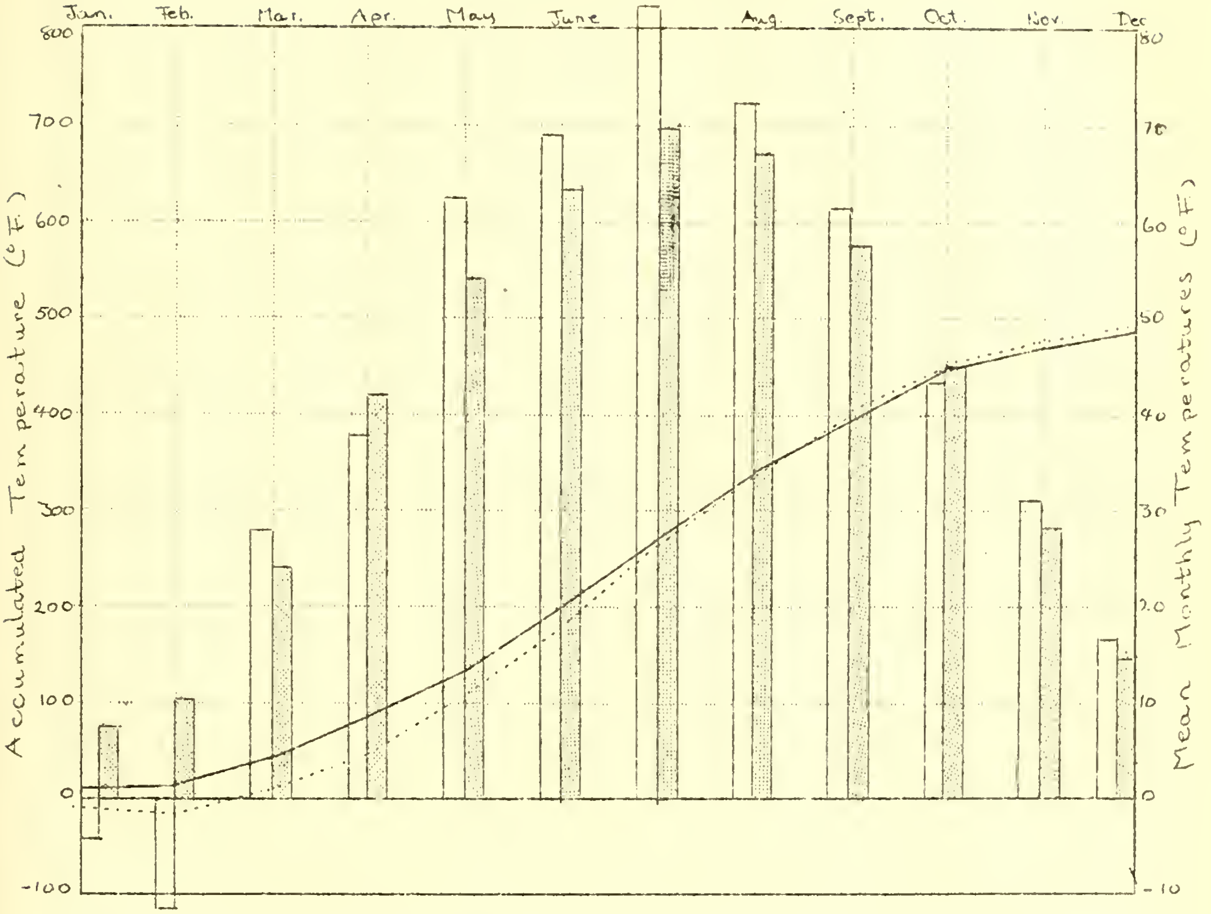


Fig. 13. Accumulated temperature in degrees F. at Bismarck, North Dakota for the year 1936 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

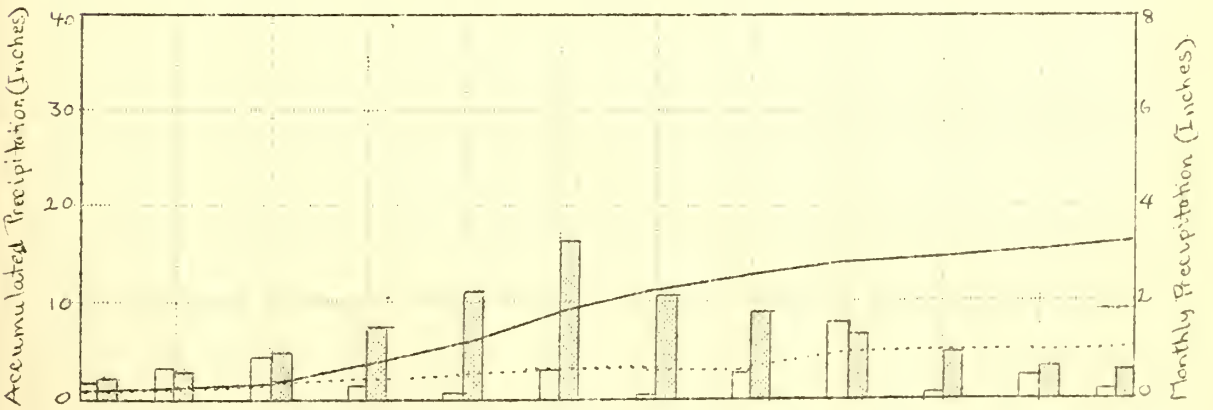


Fig. 14. Accumulated precipitation in inches at Bismarck, North Dakota for the year 1936 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

LITTLE ROCK, ARKANSAS

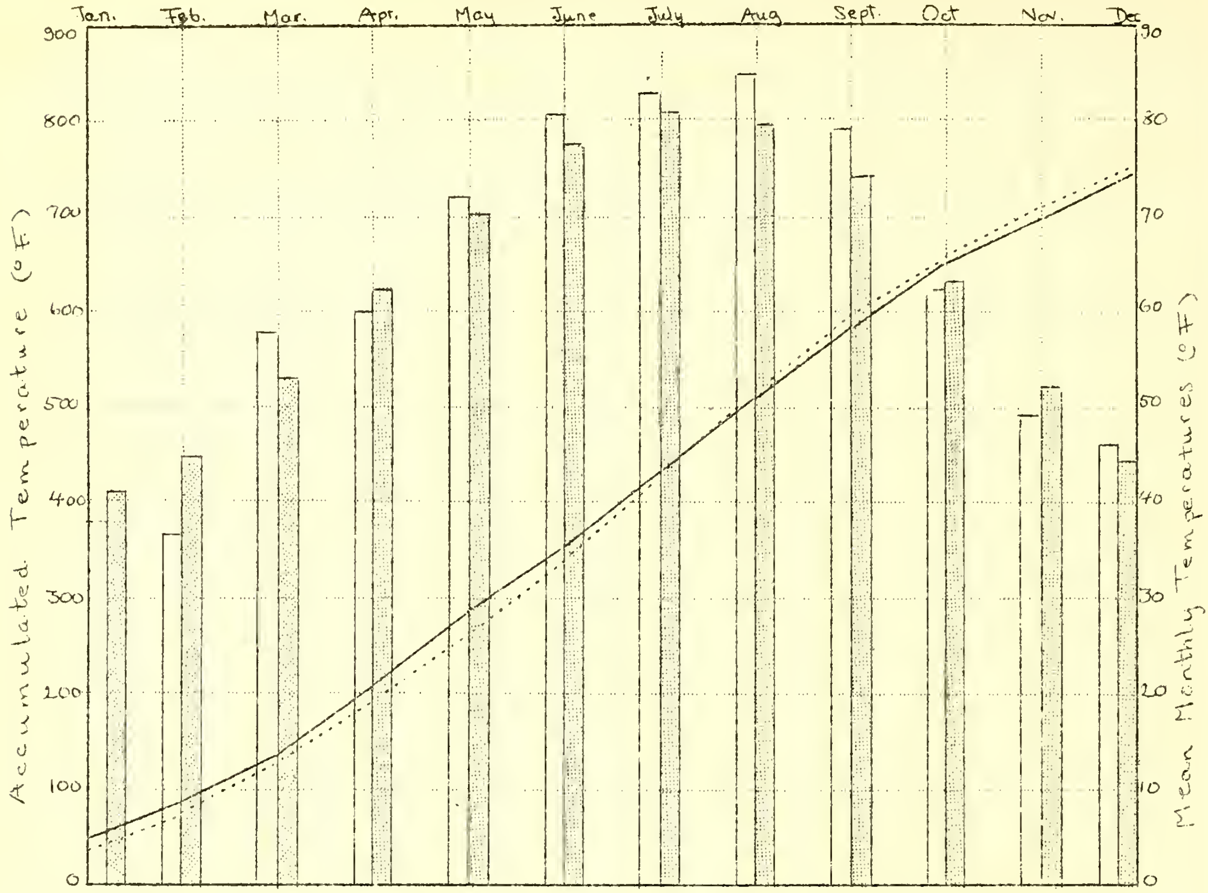


Fig. 15. Accumulated temperature in degrees F. at Little Rock, Arkansas for the year 1936 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

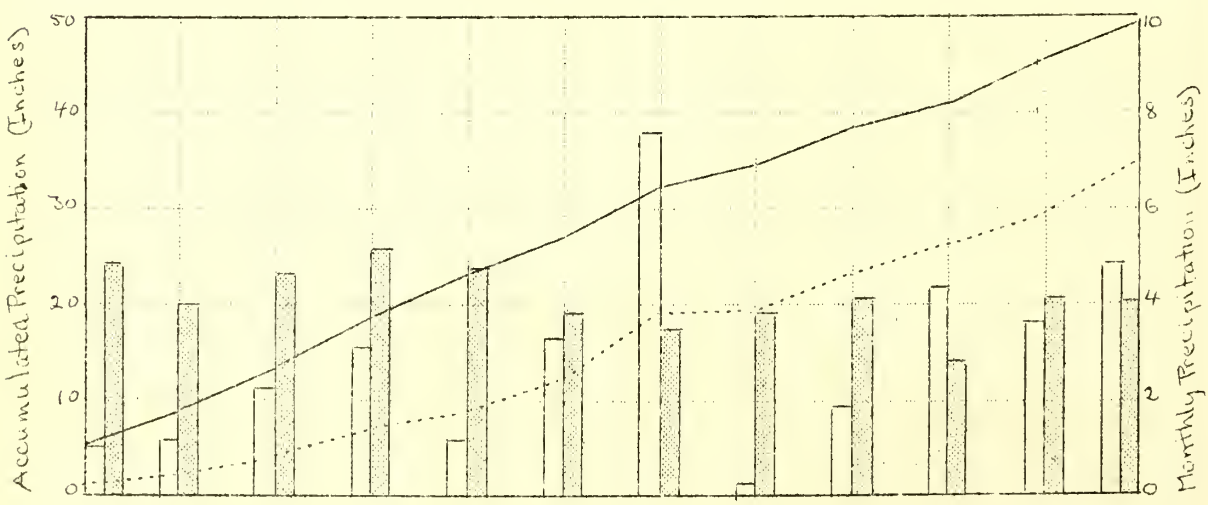


Fig. 16. Accumulated precipitation in inches at Little Rock, Arkansas for the year 1936 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

PORTLAND, OREGON

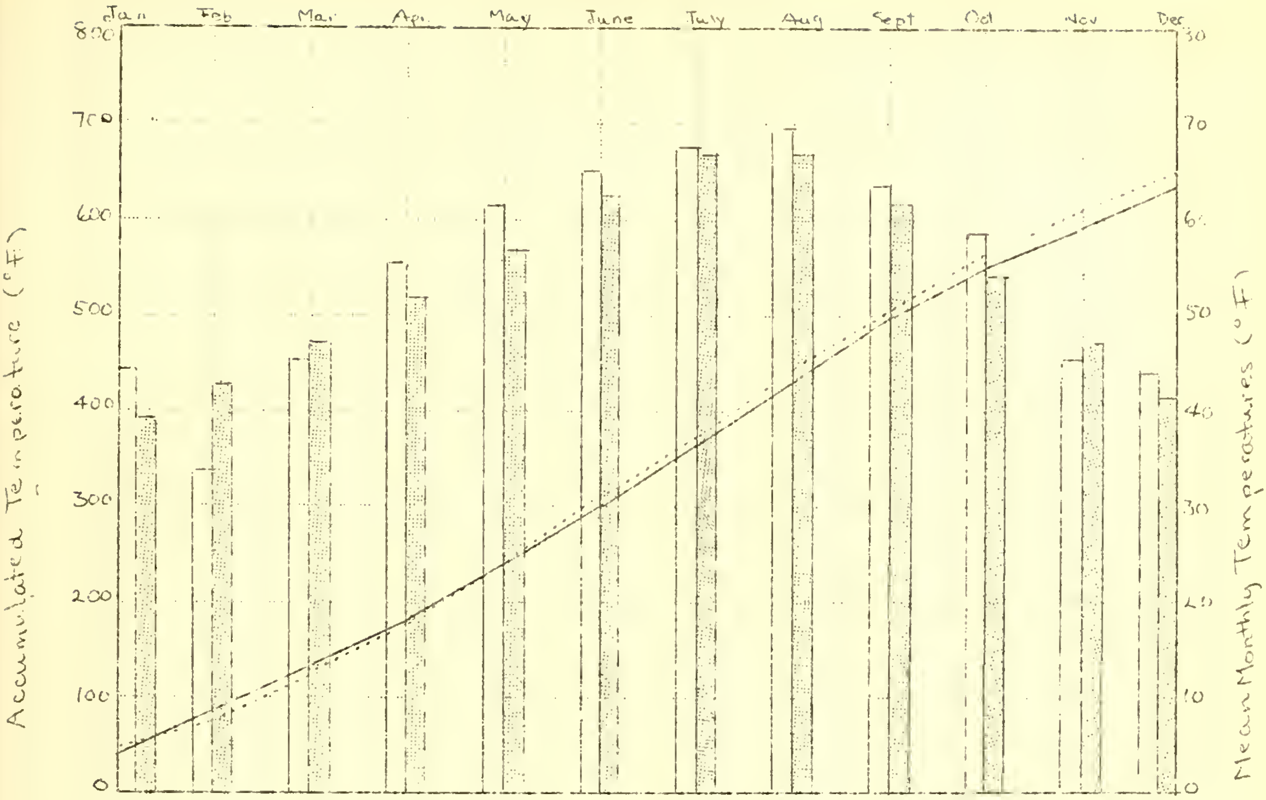


Fig. 17. Accumulated temperature in degrees F. at Portland, Oregon for the year 1936 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

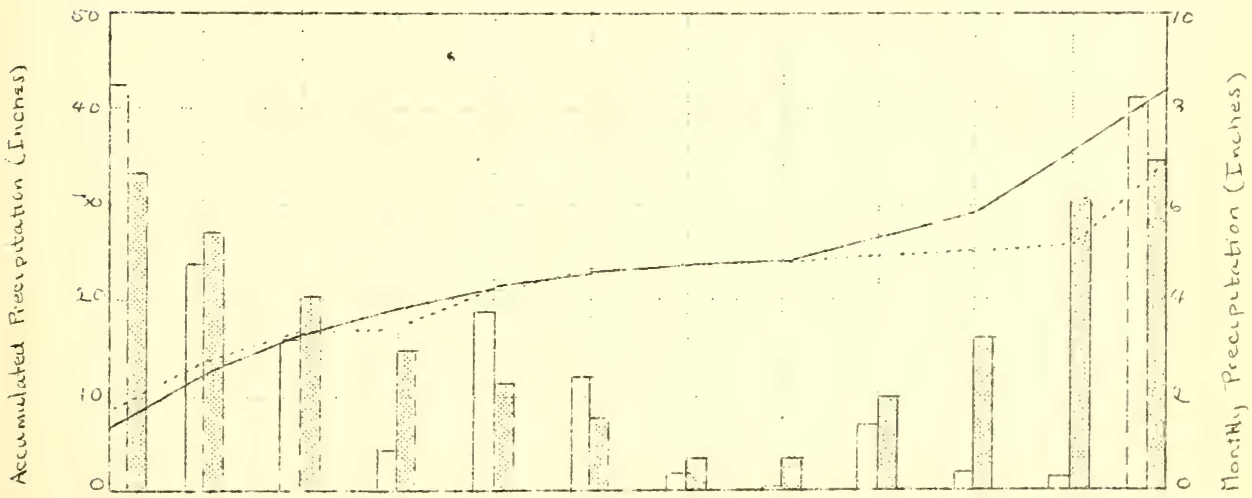


Fig. 18. Accumulated precipitation in inches at Portland, Oregon for the year 1936 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

SACRAMENTO, CALIFORNIA

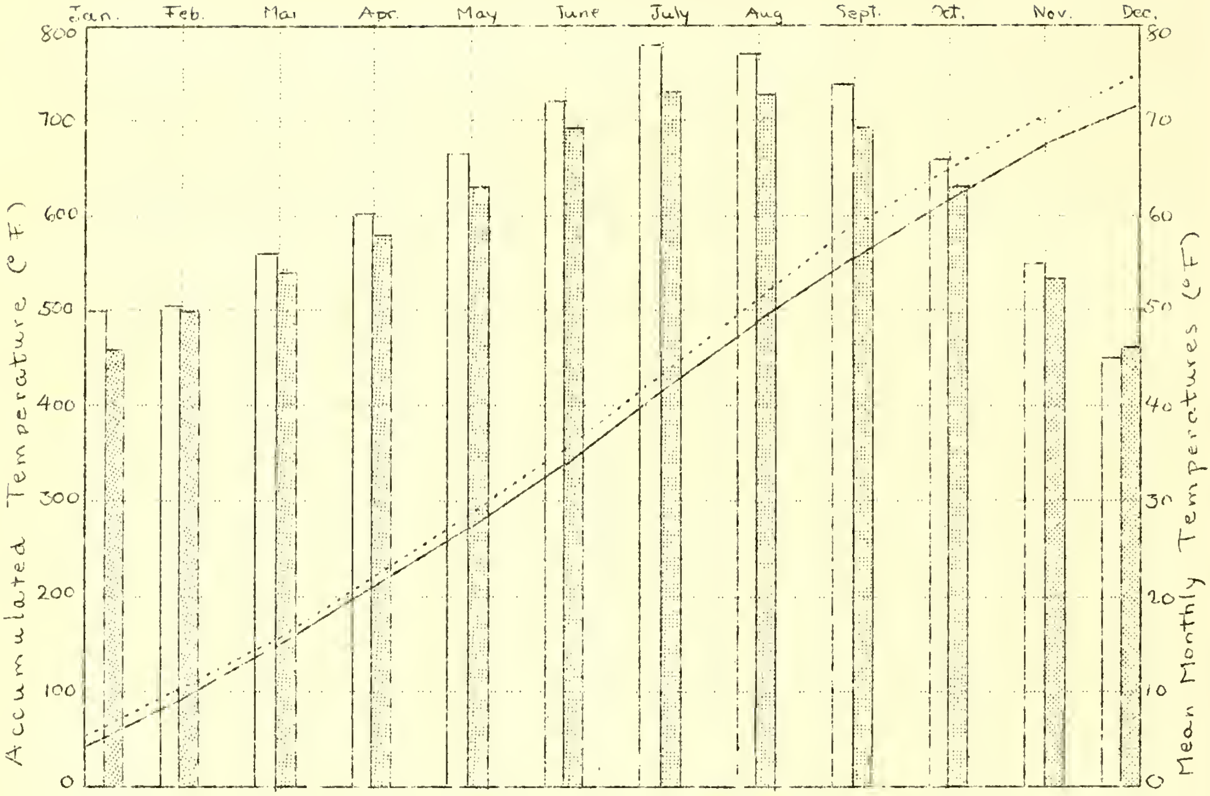


Fig. 19. Accumulated temperature in degrees F. at Sacramento, California for the year 1936 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

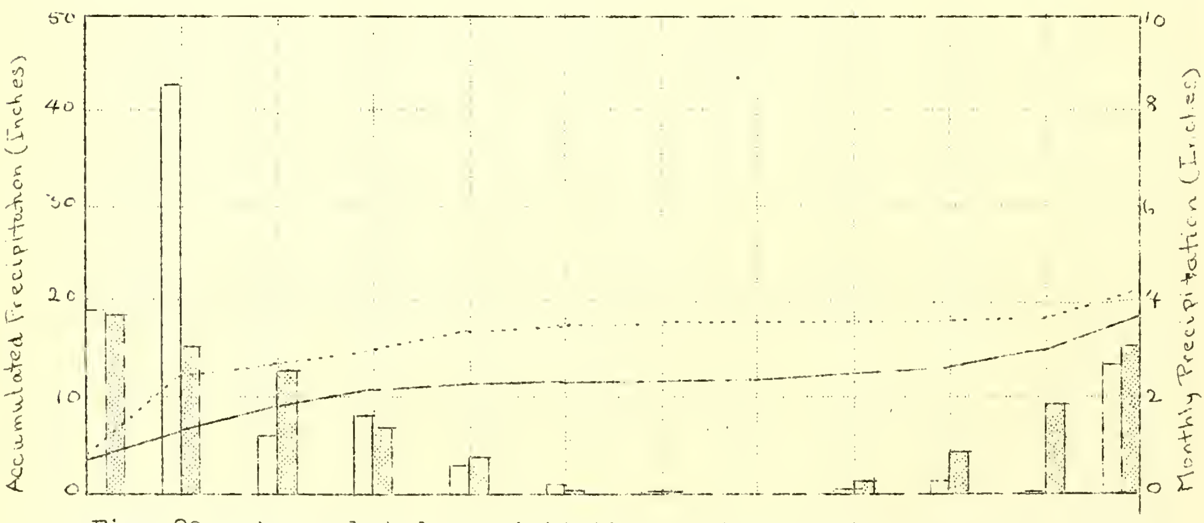


Fig. 20. Accumulated precipitation in inches at Sacramento, California for the year 1936 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

# DISEASES OF CEREAL CROPS

## AVENA SATIVA. OATS:

Root rot (*Fusarium* spp.) was present in the usual slight amounts in Michigan and Minnesota. In Oregon *F. culmorum leteius* and other species were said to be particularly widespread and destructive (P.D.R. 20:114-115).

Scab (*Gibberella saubinetii*) was reported from Maryland only.

Crown rust (*Puccinia coronata*). Except on the Atlantic Coast where there was about the usual amount, prevalence was less or much less than usual in most of the twenty-seven States reporting this disease and losses generally amounted to only traces. Several of the reports mentioned that the rust appeared late. Louisiana reported a loss of 10 percent; Georgia, 4; North Carolina, 3; Virginia, 2.5; Maryland, 2: Oklahoma and Oregon, each 1.5; and West Virginia, 1.

Stem rust (*Puccinia graminis*) was generally a negligible factor in oat production in 1936. Only four States reported losses of 1 percent or more: Mississippi, 3.5; Virginia and Oregon, each 1.5; and Massachusetts, 1. Other States' losses did not exceed a trace. Several reported that stem rust was hard to find. However, considerable damage was reported from western Washington where stem rust had previously caused very little injury.

Smut (*Ustilago avenae* and *U. levis*). In Kansas, Oklahoma, and southwestern Missouri, there was a considerable increase in the amount of smut in 1936. According to C. O. Johnston very few fields in the southern Plains region were free from the disease and infections of between 30 and 50 percent were reported in some commercial fields. Fairly dry and warm soil (soil temperature about 65-70° F.) at seeding time was reported by C. L. Lefebvre as favoring smut infection in Kansas, where the maximum amount observed in fields was said to be 66 percent and the loss for the State was estimated at 20 percent. In both Oklahoma and Missouri the loss was put at 10 percent. According to C. M. Tucker, infection was much heavier than usual in the southwestern part of Missouri, but was lighter in the northern half of the State, resulting in a total loss not much more than usual. As high as 50 percent infection was observed in Missouri fields. Outside of this area smut was reported to be of the usual importance or somewhat less, although some high percentages were reported in individual fields. As much as 40 percent occurred in fields in Pennsylvania and more than 40 percent was seen in one field of Fulghum oats in Arkansas. Loss estimates besides those already given were 10 percent in Massachusetts (estimated from counts made in August) and Pennsylvania; 5 in Maine, Maryland, West Virginia, Kentucky, Wisconsin, Montana, and Wyoming (2 percent *U. avenae*, 3 percent *U. levis*); 4 in Texas (*U. avenae*); 3.5, Virginia; 3, Georgia and Minnesota; 2.5, Ohio; 2, North Carolina, Indiana, Iowa, Arkansas, and Utah; 1.5, Michigan (1, U. avenae, 0.5, U. levis), Illinois (U. avenae); 1, New Hampshire, Louisiana, South Dakota; 0.5, Delaware; 0.4, Oregon; traces, Connecticut, Mississippi, North Dakota, and Idaho.

Anthracnose (Colletotrichum graminicolum), Texas. Powdery mildew (Erysiphe graminis), Washington. Leaf spot (Helminthosporium avenae) was reported from Illinois, Michigan, and Washington. Red leather leaf (Pseudodiscosia avenae) was common in March in the Willamette Valley, Oregon, (P.D.R. 20:114-115).

Halo blight (Bacterium coronafaciens). Less than usual was reported in Illinois and Minnesota, where losses were negligible. It was more prevalent late in the season than is usual in Iowa, where losses were estimated at 3 percent. New Jersey also reported its presence.

Blast (due largely to insufficient moisture before and during panicle emergence) although less prevalent than usual, was an important disease in Illinois where it caused a loss estimated at 8 percent. In Pennsylvania and Iowa losses of 2 percent were estimated.

BARLEY. See HORDEUM VULGARE.
CORN, FIELD. See ZEA MAYS.
CORN, SWEET. See ZEA MAYS.
FLAX. See LINUM USITATISSIMUM.

HORDEUM VULGARE. BARLEY:

Ergot (Claviceps purpurea) was less prevalent than usual. Traces were observed in Wisconsin, Minnesota, and North Dakota.

Mildew (Erysiphe graminis) was reported from New Jersey, Maryland, Virginia, Missouri, and Wisconsin. Losses were estimated at a trace except in the northeastern counties of Missouri and in Virginia where the disease was much more prevalent than usual. In Missouri the reduction in yield was estimated at 1 percent with an additional loss in grade of a like amount. The disease was not observed in North Dakota where it had been found for the first time in 1935.

Scab (Gibberella saubinetii) generally was much less prevalent than in average years and did little damage. The only losses of 1 percent or more reported were 2 percent in Maryland and 1 percent in North Carolina and Texas. Traces appeared in Pennsylvania, Virginia, Kentucky, Missouri, Ohio, Michigan, Wisconsin, Minnesota, Iowa, and Kansas.

Stripe (Helminthosporium gramineum) was widely reported as usual. Losses generally were set at a trace and did not exceed 1 percent except in Virginia, Iowa, and South Dakota where 3 percent was reported.

Spot blotch (*Helminthosporium sativum*) was reported from Michigan, Wisconsin, Minnesota, Iowa, Missouri, and North Dakota. Losses ranged from zero to 1 percent with prevalence generally less than in average years because of the dry weather.

Head blight (*Helminthosporium* sp.). Traces were observed in Wisconsin, Minnesota, and North Dakota.

Leaf rust (*Puccinia anomala*) did little damage. Only Missouri, Michigan, Wisconsin, Minnesota, and Kansas reported its presence. Losses were confined to zero or a trace and incidence was less or much less than usual except in Kansas where a considerable amount appeared in some fields of winter barley late in the season, but the infection was almost immediately dried up by hot dry weather in June. Infection on spring barley in Kansas was infrequently seen.

Stem rust (*Puccinia graminis*) caused only negligible injury in most States and was generally much less prevalent than usual. Massachusetts and Virginia each estimated the reduction in yield at 1 percent, and Iowa at 0.5. Other estimates did not exceed a trace.

Net blotch (*Pyrenophora teres*) caused losses estimated at 1 percent in Pennsylvania, Virginia, North Carolina, Wisconsin, and Iowa. In other States reporting it losses were very slight.

Scald (*Rhynchosporium secalis*) was reported from Wisconsin and California where it caused only slight injury.

Covered smut (*Ustilago hordei*) occurred in about the usual amounts or somewhat less. Losses of 1 percent or more estimated are: Kansas, 7; Pennsylvania, 6.7; Maryland, West Virginia, Kentucky, and Colorado, 3; Virginia, 2.5; North Carolina, Georgia, Montana, and Utah, 2; Minnesota, 1.5; Arkansas and Missouri, 1.

Loose smut (*Ustilago nigra*, *U. nuda*, and other species). Loose smuts were also reported to have caused about the usual loss. Estimates of 1 percent or more are: Arkansas, 8; Missouri, 4; Wisconsin, 3.5; Virginia, Kentucky, Kansas, and Colorado, 3; West Virginia, 2.5; Pennsylvania, 2.3; Maryland, North Carolina, Texas, and Wyoming, 2; Massachusetts, Georgia, Minnesota, Iowa, South Dakota, and Montana, 1.

Bacterial blight (*Bacterium translucens*), Texas.

LINUM USITATISSIMUM. FLAX:

Wilt (*Fusarium lini*) was more prevalent than usual in Wisconsin and occurred in about the usual amount in Minnesota and North Dakota. Losses were not serious because of the general use of resistant varieties. Rust (*Melampsora lini*) occurred with less than the usual prevalence in Wisconsin, Minnesota, and North Dakota. Traces of pasmo (Phlyctaena linicola) appeared in Wisconsin and Minnesota, causing practically no injury. Browning (Polyspora lini) was observed in North Dakota. Damping off (Pythium debaryanum) was very prevalent in Iowa, as in most years, and was estimated to have caused 20 percent reduction in yield. Texas and Minnesota each reported traces of injury from root rot caused by miscellaneous fungi.

Heat canker (non-parasitic). More than usual was reported from Minnesota and South Dakota, and the usual amount from North Dakota. The reduction in yield in South Dakota was said to be 20 percent, estimated on the basis of the crop harvested in proportion to the acreage that might have been harvested. Early plantings escaped. In North Dakota the loss was estimated as 0.5 percent, and in Minnesota as a trace.

OATS. See AVENA SATIVA.

ORYZA SATIVA. RICE:

Leaf spot (Cercospora oryzae) was more prevalent than usual in Louisiana where it was estimated to be the cause of a 10 percent reduction in yield. The principal loss in the very susceptible Blue Rose and Early Prolific varieties is due to the premature ripening induced and is more serious in Blue Rose because of its later maturity, according to T. C. Ryker.

Black leaf smut (Entyloma oryzae) was favored by rains throughout the season and was generally prevalent in most rice fields in Louisiana. All varieties are apparently susceptible. The disease was reported from Arkansas also.

Blast (Piricularia oryzae). A serious infestation was observed near Almyra, Arkansas, on rice grown on land cleared the previous winter. The short-grain rice was dwarfed and many of the first tillers were killed. The yield was reduced at least 50 percent. Early Prolific in the same field was less severely affected but the disease caused considerable damage to this variety also (Cereal Courier 28:178. Nov. 10, 1936). Blast was also reported from Texas.

Root rot (Pythium sp. plus poor environmental conditions) caused some damage in Louisiana where plants were being grown under unfavorable conditions such as poor soil, alkalinity, and too early flooding. A loss of 1 percent was estimated. Sheath and leaf spot from which Pythium nagaii has been consistently isolated was prevalent both in 1936 and 1935 in Arkansas (E. C. Tullis).

Kernel smut (Tilletia horrida). E. C. Tullis reported the discovery of this disease in Texas in 1936 (P.D.R. 21:30). Traces appeared in Louisiana. None was observed in Arkansas this year.

Kernel spot (Curvularia lunata /Helminthosporium curvulum/) was reported from Texas. Kernel spot (Helminthosporium oryzae) was reported as general on all varieties in Louisiana. A trace was reported from Texas. Leaf spot (Helminthosporium oryzae) was somewhat less prevalent than usual in Louisiana, where 3 percent reduction in yield was estimated. It was said to be more prevalent than usual in Texas and Arkansas. Stem and sheath rot (Leptosphaeria salvini /Sclerotium oryzae/) occurred scatteringly as usual in Arkansas. Sheath rot was present in most fields in Louisiana. The disease was also reported from Texas. Foot rot (Ophiobolus oryzinus) appeared late in the season and was of slight importance as usual, in Arkansas. Sheath spot (Rhizoctonia sp.) caused a 0.5 percent loss in Louisiana.

Traces of straight head (undetermined) were reported from Texas and more than the usual prevalence scatteringly distributed from Arkansas. White tip (undetermined), which is usually of some importance in Louisiana, was much less prevalent than usual in 1936. It was not observed in the river section. The disease is apparently favored by high temperatures. Rexora seems to be immune, Fortuna is resistant, while Blue Rose and Early Prolific are very susceptible.

RICE. See ORYZA SATIVA.
RYE. See SECALE CEREALE.

SECALE CEREALE. RYE:

Ergot (Claviceps purpurea) was reported in mostly negligible amounts in the area from Massachusetts to North Dakota, south to Virginia and Iowa, and from Oregon. The only losses of more than a trace were 2 percent in South Dakota, and 1 percent in Massachusetts. In both North and South Dakota hot dry weather at blossoming time prevented infection according to collaborators.

Anthracnose (Colletotrichum graminicolum) was found causing leaf spot in one field in Illinois. It was also reported from Wisconsin. Powdery mildew (Erysiphe graminis) was observed in trifling amounts in Connecticut, New Jersey, Virginia, and Michigan. Scab (Gibberella saubinetii) was reported only from Wisconsin where prevalence was much less than in 1935. Stem rust (Puccinia graminis) was relatively unimportant causing little or no loss in the States reporting it. Leaf rust (Puccinia rubigo-vera secalis) caused reductions in yield of 1 percent or more in Pennsylvania, 6; Rhode Island, 5; Wisconsin, 3; Massachusetts, Virginia, and Texas, 1. Stem rust (Urocystis occulta) was nowhere reported as causing more than a trace of reduction in yield. It occurred in Pennsylvania, West Virginia, Texas, Illinois, Ohio, Michigan, Wisconsin, Minnesota, and Iowa. Bacterial blight (Bacterium translucens secalis) was observed locally in Minnesota.

SORGHUM VULGARE. SORGHUM:

Fusarium diseases (Fusarium spp.) were reported from Texas as follows: Root rot of milo, 6 percent injury; stalk rot of milo, 2; head mold of hegari, 2; grain mold of kaffir, 2.

Leaf spot (Helminthosporium sp.) and rust (Puccinia purpurea) were reported from Texas on milo.

Pythium root rot. Pythium arrhenomanes was reported from Kansas, and Pythium sp. from Imperial County in California. There was less of the disease than usual in Kansas but it was more prevalent than formerly in California.

Charcoal rot (Rhizoctonia bataticola) occurred in Texas, on hegari.

Head smut (Sorosporium reilianum) was reported in traces from Texas, Wisconsin, and Kansas. Loose kernel smut (Sphacelotheca cruenta) caused a loss of 4 percent in Texas. Covered kernel smut (Sphacelotheca sorghi): Texas reported 4 percent on sorghum and 3 on milo; Wisconsin, the usual incidence on sorghum; Minnesota, more than the usual prevalence locally; and Kansas, less than usual with scattered distribution as the extreme drought reduced the crop. Most fields in the State either did not head or headed late and did not mature grain.

Molds (various organisms) were reported from Texas as follows: Aspergillus spp. on hegari and kaffir causing respectively 2 and 3 percent injury. Various organisms as hay molds caused losses amounting to 6 percent.

Bacterial stripe (Bacterium andropogoni) and bacterial streak (B. holcicola) were generally prevalent in the sorghum areas of Texas, Oklahoma, Kansas, Nebraska, and Colorado. In many cases the foliage was severely injured. (R. W. Leukel).

TRITICUM AESTIVUM. WHEAT:

Ergot (Claviceps purpurea). In Wisconsin, Minnesota, and North Dakota, ergot was less prevalent than in 1935 and caused no appreciable injury.

Mildew (Erysiphe graminis). Light infestations were reported from New Jersey, Pennsylvania, Virginia, Texas, and Michigan, and a heavy infestation was reported on winter wheat at Manhattan, Kansas, in May.

Foot and root rots (Fusarium sp.). See Foot and Root Rots, Helminthosporium.

Scab (Gibberella saubinetii) was of very little importance in 1936. It was reported as follows: New Jersey; Pennsylvania, less prevalent than usual, average percentage of spikelets infected, 0.115, loss a trace; Maryland, reduction in yield, 1 percent, reduction in grade 1; Kentucky, no scab in nursery; North Carolina, common; Texas, 1; Arkansas, no data; Illinois, not seen in the State in 1936; Michigan, no report of loss and little scab seen; Wisconsin, a trace; Minnesota, much less than usual, no loss; Iowa, less, loss 0.5 percent; North Dakota, less, a trace.

Foot and root rots (Helminthosporium sativum, Fusarium spp., and various organisms). Helminthosporium sativum caused foot-rot as follows: Pennsylvania, found in 5 out of 113 fields surveyed, average percent of infection, 0.09 percent, loss, a trace; North Carolina, severe; Texas, 1 percent; Oklahoma, less than usual; Michigan, a few plants in experimental plot with heavy infection, little damage over the State; Wisconsin, a trace; North Dakota, usual prevalence, loss in yield 1 percent. This organism in conjunction with Fusarium and others caused injury in Minnesota and Kansas resulting in estimated loss of 1 and 2 percent respectively. Iowa reported 1 percent loss from various organisms.

Take all (Ophiobolus graminis) was found in only one of 124 wheat fields surveyed in Pennsylvania. Incidence in this field was 0.2 percent. The disease was much less prevalent in Kansas than in former years although it was found on a few farms.

Stripe rust (Puccinia glumarum). Washington.

Stem rust (Puccinia graminis). In only a few of the 31 States from which reports on stem rust were received did the estimated loss exceed a trace. These are Utah, 5 percent; Virginia and Idaho, each 2; Pennsylvania, 1.5; Massachusetts and West Virginia, each 1; Iowa and Kansas, each 0.5.

Leaf rust (Puccinia rubigo-vera tritici). Pennsylvania, found in each of 113 fields surveyed, average percentage of infection 90.9, started earlier in the spring than usual and became severe about blooming time, loss 13 percent; Maryland, less than last year, reduction in yield, 0.75 percent, total loss 1.5; Virginia, Kentucky, trace; North Carolina, slight; Texas, 2; Oklahoma, much less, too dry; Arkansas, trace; Ohio, Illinois, 0.5; Michigan, trace; Wisconsin, 5; Minnesota, trace; Iowa, 1; Missouri, trace, general but very light infection; North Dakota, scarcely any; South Dakota, trace; Kansas, 0.2; Wyoming, slight trace; Colorado, 1.

Glume blotch (Septoria nodorum) was less prevalent than usual in Pennsylvania and Maryland, the only two States reporting its presence. Losses were estimated at 1.5 and 1 percent respectively including injury in grade as well as reduction in yield.

Speckled leaf blotch (Septoria tritici) caused only a trace of loss in Pennsylvania. It was more prevalent than in 1935 in Illinois where the loss was estimated at 5 percent and, in Kansas, where the disease was found nearly everywhere on wheat.

Bunt (Tilletia levis and T. tritici). The presence of one or both species was reported as follows: New Jersey, general throughout the State, Pennsylvania, more than in 1935 and much more than in an average year, reduction in yield, 5 percent, "Bunt occurred in 84 out of 123 fields surveyed or 68.3 percent of the untreated fields. It was found in 6 out of 6 treated fields where smut balls were not removed. A trace occurred in 1 field out of 16 where wheat was treated as recommended"; Maryland, reduction in yield 2 percent, loss in grade 3; North Carolina, common; Texas, 2; Arkansas, trace; Illinois, "Infection ranged from a trace to 2 percent, reduction in yield averaged only a trace"; Michigan, 5; Wisconsin, 1; Minnesota, 0.5; Iowa, 2; Missouri, "Reports from Kansas City market showed some receipts of smutted wheat from Missouri River bottom lands in western half of the State. Fields not visited"; North Dakota, 0.3, "Large areas of wheat destroyed by drought before it matured smut"; Kansas, 0.3; Wyoming, 1.5; Colorado, 3.

Flag smut (Urocystis tritici) occurred locally in Kansas in about the usual amount. It was abundant in one field of Harvest Queen where there had been protection from the cold north and northwest winds. (A. G. Johnson).

Loose smut (Ustilago tritici). Pennsylvania reported loss in yield and grade of 2.5 percent. It appeared in 109 out of 111 fields surveyed. Two fields planted with hot-water-treated seed had no loose smut. In Maryland it was more prevalent than usual and caused reductions in yield and in grade of 1 percent each. Other reports were as follows: North Carolina, common; Illinois, much more prevalent, loss 0.9 percent; Michigan, 5; Wisconsin, trace; Minnesota, trace; Mississippi, trace; Texas, 3; Arkansas, present in small amount; Iowa, 1; Missouri, more than usual, 4; North Dakota, less than in an average year, 0.4; South Dakota, 1; Kansas, 0.2.

Basal glume rot (Bacterium atrofaciens) was very sparingly present in Illinois. Black chaff (Bacterium translucens undulosum) appeared in traces in Wisconsin, North Dakota, and Kansas.

WHEAT. See TRITICUM AESTIVUM.

ZEA MAYS. FIELD CORN:

Basisporium dry rot (Basisporium gallarum /Nigrospora sphaerica/) was specifically reported only from Illinois and Wisconsin although it probably occurred in other States as well.

Black bundle (Cephalosporium acremonium) was general and more prevalent in Illinois than in average years and was estimated to have reduced the yield 7.5 percent.

Ear and stalk rot (Diplodia zeae) was reported, mostly in the usual amounts, from the following States with losses as indicated: Massachusetts, 2 percent; New Jersey, general but not serious; Pennsylvania, trace; Delaware, trace; Maryland, 0.5; Virginia, 1; West Virginia, 2; Kentucky, 1.5; North Carolina, trace; Georgia, 2; Texas, 2; Oklahoma, 3; Ohio, 0.5; Indiana, 1; Illinois, 1.5; Michigan, 0.3; Wisconsin, trace; Minnesota, trace; Iowa, 10.

Damping off (Fusarium sp.) caused some damage in Oklahoma but was less prevalent than usual.

Stalk rots (Fusarium spp.) caused a reduction in yield in Wisconsin of 5 percent and a total loss of 0.5 percent in North Dakota.

Root rot (Fusarium spp.) was reported as not very common in New Jersey, present in Texas to the extent of 5 percent, and causing 1 percent loss in Minnesota.

Ear rot and seedling blight (Gibberella saubinetii). Losses from ear rot were reported as follows: Texas, 2 percent; Illinois, 1; Michigan, 0.3. Seedling blight appeared in small amounts in Wisconsin.

Brown spot (Physoderma zeae-maydis) developed on flooded lands in Illinois and was reported as locally severe in Ventura County, California. (P.D.R. 20:293; 21:79).

Rust (Puccinia sorghi) was of negligible importance, as usual.

Charcoal rot (Rhizoctonia bataticola) was observed in Missouri for the first time.

Head smut (Sorosporium reilianum), Washington.

Smut (Ustilago zeae). High temperatures were reported as favoring the development of smut with a resultant increase in amount in several midwestern States, including Illinois, Michigan, Iowa, Missouri, and South Dakota. Wisconsin, North Dakota, and Kansas reported less than usual. In Missouri, however, the drought reduced the corn crop so much that smut was not an important factor in yield and a similar condition was reported from Kansas. Sundstrom's Hybrid No. 56 was reported as very resistant in South Dakota, while all ordinary mass-selected varieties were said to be susceptible. Loss estimated (reduction in yield unless stated otherwise) was 25 percent in South Dakota, of which 10 percent was reduction in yield; 7 in Minnesota;

6 in Colorado; 5, Iowa; 4.5, Michigan; 4, Pennsylvania; 3.7, Illinois; 3, Virginia, North Carolina, Georgia, and Texas; 2, Massachusetts, Ohio, and Utah; 1.5, Wisconsin; 1, Kentucky, Oklahoma, North Dakota, Kansas, and Wyoming; 0.5, Louisiana and Indiana; trace, New Hampshire, Delaware, Arkansas, Idaho, and Oregon. West Virginia and California also reported its occurrence.

Ear rots (various fungi other than Diplodia). Aspergillus flavus and A. niger were much more prevalent than usual in Illinois causing a loss estimated at 5 percent. Fusarium spp. were reported as follows: New Jersey; Texas, 1 percent; Illinois, 3.5; Michigan, trace; Wisconsin, 1, Minnesota, 0.5; South Dakota, 8 percent reduction in yield and 10 in grade. Penicillium sp. caused reductions in yield estimated at 10 percent in Illinois and traces of loss in Wisconsin. Phoma zeicola was reported in traces from Texas. Rhizopus sp. reduced yields by 3 percent in Illinois. Various molds other than Diplodia were reported as follows: Maryland, loss in yield 1.5 percent and in grade 1.5; Iowa, 3; Kansas 0.5.

Root rots (various fungi other than Diplodia) were reported less prevalent than usual in Maryland where reduction in yield was estimated at 2 percent with an additional 2 percent loss in grade. Other States reporting were Mississippi; Illinois, reduction in yield 6 percent; and Colorado, trace.

Stalk rots (various fungi other than Diplodia). Maryland reported losses of 1 percent reduction each in yield and grade, Illinois 2.5 percent loss in yield, and Kansas reported trouble due to parasitic and non-parasitic causes difficult to analyze because of the drought.

Bacterial wilt (Aplanobacter stewarti) was observed in Massachusetts to a small extent in one field of Pearl popcorn in an isolated field that had not grown corn in recent years. The seed was locally grown in 1934. The disease was also observed on popcorn in Texas. Other reports of wilt on field corn were a trace in Pennsylvania and Maryland; and 1 percent in Texas. In Michigan, Wisconsin, and Kansas, the disease was not observed on field corn in 1936.

Bacterial stalk rot (Bacterium dissolvens) occurred in unusual prevalence on flooded land in southern Illinois. In 5 fields an average of 2.3 percent of the stalks were infected. This is the first observation of the disease in the State since 1932. Traces of loss were also reported from Missouri, where the disease was confined to bottom lands. See P.D.R. 20: 293.

Phosphorus deficiency (non-parasitic) was important in many fields in central Illinois (P.D.R. 20:209-210).

ZEA MAYS. SWEET CORN:

Ear and stalk rot (Diplodia zeae) developed as follows: Maine, trace; Massachusetts, 2 percent; Pennsylvania, 3; Virginia, 0.5; West Virginia, 2; Texas, 3; Ohio, trace; Indiana, trace; Michigan, 0.1; Wisconsin, 5; Minnesota, trace; Iowa, 3.

Leaf blight (Helminthosporium turcicum) was less prevalent in Massachusetts than for the past three years.

Rust (Puccinia sorghi) was general and unusually prevalent in both Massachusetts and New York but did little damage. In Nassau County on Long Island, 100 percent infection developed in all fields after August 1, but no loss resulted. Rust was also reported from Connecticut.

Smut (Ustilago zeae) was very prevalent on sweet corn as follows: Maine, reduction in yield a trace; Massachusetts, more prevalent, 6 percent; Rhode Island, trace; Connecticut, 3; New York, seemingly increasing each year, especially on the extra early yellow varieties, very abundant this year, 5 to 10 percent loss on extra early varieties, 1 to 2 on later varieties; New Jersey, prevalent as usual; Pennsylvania, usual amount, 6; Delaware, very general in sweet corn plantings; Maryland, usual amount, 1; Virginia, 1; West Virginia, 3; Texas, 10; Ohio, 1; Indiana, 5; Michigan, more than usual, 5; Wisconsin, 5; Minnesota, much more prevalent, 7; Iowa, more, 7; North Dakota, 1; Kansas, trace; Wyoming, trace; Colorado, 5; Idaho, trace.

Root rots (various fungi) caused a reduction in yield in Maryland estimated at 4 percent. Fusarium spp. and Penicillium spp. appeared in Minnesota in about the usual quantity.

Ear rots (various fungi) were reported less prevalent than usual in Maryland and Minnesota.

Bacterial wilt (Aplanobacter stewarti) was definitely less destructive than for several years. Reports are briefly summarized as follows: Massachusetts, not seen at all; Connecticut, only one report; New York, almost lacking entirely upstate, less prevalent than last year on Long Island, trouble confined almost entirely to local areas in Nassau County; New Jersey, much less prevalent than in past several years, Whipple's Yellow, which in previous years showed as high as 50 percent, showed only a trace in 1936; Pennsylvania, much less, trace, use of common resistant varieties has cut losses very much; Maryland, much less, 0.1; Virginia, 1.5, "At Arlington Farm, Virginia, susceptible varieties were 100 percent infected at maturity but only about 10 percent were killed by bacterial wilt" (Charlotte Elliott); West Virginia, 3; Kentucky, in a few plantings seen there was no wilt present; Texas, 3; Ohio, very scarce this year, 0.5; Indiana, trace; Michigan, much less than usual, no reports; Wisconsin, some on early Golden Bantam; Iowa, less, trace; Kansas, no reports; California, serious in sweet corn, several plantings destroyed. See also P.D.R. 20:248-254.

# DISEASES OF FORAGE AND COVER CROPS

## LEGUMES

ALFALFA. See MEDICAGO SATIVA.
AUSTRIAN WINTER PEA. See PISUM ARVENSE VAR.
CLOVER. See TRIFOLIUM spp.
COWPEA. See VIGNA SINENSIS.

MEDICAGO SATIVA. ALFALFA:

Root rot (Armillaria mellea). Root infections developed on alfalfa grown as a cover crop in a California prune orchard where the trees were affected. No alfalfa plants were killed. (Scott).

Downy mildew (Peronospora trifoliorum) was reported from Connecticut, New Jersey, Wisconsin, Kansas, Wyoming, Washington, where it caused considerable damage in some plantings, and California.

Root rot (Phymatotrichum omnivorum). C. J. King reported the discovery of this fungus in Nevada in the Virgin and Moapa River Valleys. (P.D.R. 20:202). A loss of 10 percent was estimated in Texas.

Black stem (Pleospora rehmiana /Phoma medicaginis, Ascochyta imperfecta/). Kansas was the only State reporting black stem in 1936. It was said to be less prevalent than usual and the loss was estimated at 2 percent.

Leaf spot (Pseudopeziza medicaginis) was reported as follows: Massachusetts, early infection severe, dry weather checked it; New Jersey, very severe in some plantings; Michigan, trace; Wisconsin, less than usual, too dry and hot; Minnesota, less, too dry; Iowa, 3 percent; Missouri, much less, trace; North Dakota, less; Kansas, usual amount, 0.1 percent reduction in yield; Wyoming, usual trace; Washington, present to a greater or less extent in all plantings visited; California, general.

Leaf spot (Cercospora medicaginis) caused losses of 0.5 percent in Texas and 2 percent in Iowa. Anthracnose (Colletotrichum trifolii), Texas. Powdery mildew (Erysiphe polygoni), Wyoming. Root rot (Fusarium spp.), Minnesota. Yellow leaf blotch (Pyrenopeziza medicaginis): Kansas, less than usual, 2 percent; and Washington. Damping off (Pythium sp.) appeared in about the usual amount in Kansas. It occurs wherever alfalfa is sown on fallow ground. Stem rot (Sclerotinia trifoliorum) caused 25 percent loss in a newly seeded field of Grimm alfalfa in West Virginia. Rust (Uromyces medicaginis), New Jersey, Texas, and California. Crown wart (Urophlyctis alfalfae), Texas.

Bacterial wilt (Aplanobacter insidiosum) was reported from Massachusetts, more than usual, dry in late June, July, and part of August, loss 10 percent; Connecticut, found in one field; Wisconsin, usual slight amount; Iowa, less, loss 10 percent; Kansas, much less, too dry, occurred in eastern part of State, loss 1 percent; and Wyoming, only in irrigated fields, loss 10 percent.

Virus diseases. Mosaic was very prevalent in alfalfa plantings visited in central Washington (L. K. Jones, P.D.R. 20:230). Witches' broom due to virus and yellow top, possibly a virus disease, were also reported from Washington.

MELILOTUS spp. SWEET CLOVER:

Leaf spot (Cercospora davisii) was less prevalent than usual in Iowa where it caused 1 percent loss. Root rot (Fusarium sp. and other Fungi Imperfecti) was observed in Minnesota in about the usual amount. Root rot (Phymatotrichum omnivorum): Ten percent loss was reported in Texas.

Mosaic (virus) was generally distributed in about the usual amounts in Minnesota. The Alpha variety was said to be susceptible.

PISUM ARVENSE var. AUSTRIAN WINTER PEA:

See P.D.R. 20:210-212 for a report on diseases of this important plant in the Southern States.

SOJA MAX. SOYBEAN:

This is an important crop from many viewpoints but diseases were very incompletely reported. Root rot (Phymatotrichum omnivorum) occurred in Texas. Stem rot (Sclerotium rolfsii) was severe throughout the sandy soil areas but was not so important on the black lands of eastern North Carolina. Bacterial pustule (Bacterium phaseoli sojense) occurred in New Jersey, North Carolina, and Louisiana. Mosaic (virus) was reported from New Hampshire.

SWEET CLOVER. See MELILOTUS spp.

TRIFOLIUM spp. CLOVER:

Powdery mildew (Erysiphe polygoni) was observed as follows: on T. pratense in Connecticut, Virginia, Minnesota, where marked difference in susceptibility in selections of standard varieties were noted, and in Iowa; on Trifolium spp. in Massachusetts as early as May 15, New Jersey, common and severe throughout the State, and Wisconsin.

Sooty spot (*Phyllachora trifolii*) was reported from New Hampshire on *T. hybridum* and *T. pratense*; on *Trifolium* sp. from New Jersey; and from Washington on *T. repens*.

Rusts (*Uromyces* spp.). *Uromyces trifolii* was reported on *T. pratense* from Connecticut; on *T. hybridum* from Texas, and on *Trifolium* spp. from Massachusetts, Connecticut, New Jersey, and Texas. *U. minor* was collected on *T. parryii* in Wyoming.

Anthracnose (*Colletotrichum trifolii*), New Jersey, trace present in a few fields; Texas, trace. Root rot (*Fusarium* spp.) was general in Minnesota on *T. pratense*. Anthracnose (*Gloeosporium caulivorum*) found in 10 percent of the red clover fields in southeastern Minnesota; Wisconsin, less than usual. Leaf spot (*Macrosporium sarcinaeforme*), Minnesota, on *T. pratense*. Slime mold (*Physarum cinereum*), Pennsylvania on *T. repens*. Root rot (*Sclerotinia trifoliorum*) occurred in New Jersey on *T. incarnatum*. It caused minor losses in the Piedmont region of North Carolina.

Mosaic (virus) was reported general throughout New Jersey on *T. pratense*.

VETCH. See VICIA spp.

VICIA spp. VETCH, BROAD BEAN:

Leaf spot (*Ascochyta pisi*), New Jersey and Oklahoma. Spotted wilt (virus), California on *V. faba*.

VIGNA SINENSIS. COWPEA:

Powdery mildew (*Erysiphe polygoni*). Texas and California. The California material collected by Mackie at Camarillo was found by Dundas to be the same as strain No. 1 on beans.

Root rot (*Fusarium martii phaseoli*) was less prevalent than in an average year in Oklahoma.

Wilt (*Fusarium vasinfectum tracheiphilum*) was common throughout North Carolina where it caused severe losses in sandy soils. It was reported as less prevalent than usual in Texas and Oklahoma. It was general and very important as usual on Blackeye cowpea in California. The new varieties Calva No. 2 and Calva No. 35 were immune, according to J. B. Kendrick.

Root and stem rot (*Rhizoctonia* spp.). Texas reported 1 percent of trouble due to *Rhizoctonia* sp., Texas and California a root and stem rot (charcoal rot) caused by *R. bataticola*, and California a root canker due to *R. solani*.

Wilt (Verticillium albo-atrum). The organism was isolated from diseased cowpea plants infected principally with Rhizoctonia collected in the Sacramento Valley, California, in September 1935. There does not seem to be any previous record of V. albo-atrum on cowpea (Rudolph and Snyder, P.D.R. 20:125-126).

Leaf spot (Cercospora cruenta), New Jersey and Texas. Less anthracnose (Colletotrichum lindemuthianum) than usual occurred in Oklahoma. Stem rot (Sclerotium rolfsii), Texas. Rust (Uromyces vignae), Texas.

Mosaic (virus). In California a mosaic was found in experimental plots. It does not resemble cowpea mosaic of the East. (Gardner).

GRASSES

AGROPYRON spp. WHEATGRASS: Ergot (Claviceps purpurea) was reported from Wyoming on A. dasystachyum and A. pauciflorum.

AGROSTIS spp. BENTGRASS: Stem rust (Puccinia graminis) was reported on A. alba from Connecticut and Pennsylvania. Brown patch (Rhizoctonia sp.): Massachusetts reported the least of this trouble in years. It was common in several golf courses in New Jersey. On putting greens in Michigan it was much more troublesome than usual because of the high temperatures and the use of large quantities of water. Dollar spot (Sclerotinia homoeocarpa F. T. Bennett), Michigan, see brown patch. Snow mold (Typhula graminum), New Jersey and Pennsylvania. Smut (Ustilago striaeformis): Illinois reported a single observation on 0.4 percent of the culms in a 15-acre field of A. alba. It is usually common on roadside red top but rare in cultivated fields.

BROMUS sp. BROMEGRASS: Smut (Ustilago bromivora), Wyoming, on B. polyanthus.

ELYMUS spp. WILD RYE: Ergot (Claviceps purpurea) on E. condensatus and E. glaucus in Wyoming.

HORDEUM sp. WILD BARLEY: Leaf spot (Scolecotrichum graminis), Wyoming, on H. jubatum.

ORYZOPSIS HYMENOIDES. INDIAN RICE GRASS (QUINCY GRASS): Smut (Ustilago hypodytes), Washington.

PHLEUM PRATENSE. TIMOTHY: Stem rust (Puccinia graminis) was reported as epiphytotic on Nantucket Island, Massachusetts.

POA spp. BLUEGRASS: Ergot (Claviceps purpurea) on P. canbyi from Wyoming. Leaf spot (Helminthosporium vagans), New Jersey. Slime mold (Physarum cinereum), Pennsylvania, on P. pratensis.

SORGHUM VULGARE SUDANENSE. SUDAN GRASS: Anthracnose (Colletotrichum lineola), Texas. Leaf blight (Helminthosporium turcicum) severely injured plots at Beltsville, Maryland. It was also reported from Texas. Rust (Puccinia purpurea), Texas. Bacterial stripe (Bacterium andropogoni), Texas.

## DISEASES OF FRUIT CROPS

### AMYGDALUS PERSICA. PEACH:

Shot hole (Cercospora circumscissa) was common in Texas.

Scab (Cladosporium carpophilum) was reported as follows: Massachusetts, due to heavy carry-over on twigs, it was much more damaging than usual in home orchards and more troublesome in commercial orchards; Connecticut, more common than for several years; New York, largely limited to southern Hudson Valley; New Jersey; Pennsylvania, less than in an average year; Delaware, unsprayed trees showed heavy infection, sprayed plantings a trace; Maryland, more than usual, about the same amount as in 1935, injury in grade about 2 percent; Virginia much less than usual, only on unsprayed trees; North Carolina, not important in commercial orchards, untreated seedling peaches were heavily infected; Mississippi, abundant in all orchards observed; Texas; Arkansas, trace, dry weather unfavorable; Illinois, scattered infections in the southern portion of State, no appreciable loss; Michigan, much less than usual; Iowa, no loss; Kansas, much less than usual, same as in 1935; Oregon, heavy infection in one unsprayed orchard in poor culture, but properly cared for orchards were seemingly free.

Blight (Coryneum beijerinckii) occurred in about the usual prevalence in Washington, Oregon, and California. It was reported for the first time as being of considerable importance on peach fruits in some southern Idaho areas, as a result, probably, of above-normal precipitation. It is a common disease in northern Idaho. (P.D.R. 21:90).

Powdery mildew (reported as Podosphaera oxyacanthae). A light infection was observed at Twin Falls, Idaho, in September.

Brown rot (Sclerotinia spp.). Washington reported S. cinerea and winter injury jointly responsible for damage and California reported Sclerotinia sp. as becoming of increasing importance in both clings and freestones as a fruit rot. S. fructicola was reported as follows: Massachusetts, damaging only to the latest varieties; Connecticut, not bad in most orchards; New York, less than usual, same as in 1935; New Jersey; Pennsylvania, less than average amount, reduction in yield estimated at 6 percent with an additional loss in transit of 2 percent; Delaware, much less than usual, first traces appeared on fruit following curculio injury, not generally severe; Maryland, more than usual, 6 percent; Virginia, only where fruit was not properly sprayed; North Carolina, seems to be becoming more severe as blossom blight, especially on Red Bird, Mayflower, and other early varieties; Mississippi, only traces; Texas; Arkansas, conspicuous by its absence, dry weather unfavorable; Illinois, much less than usual; Iowa, practically none; Kansas, much less than in an average year.

Powdery mildew (Sphaerotheca pannosa persicae) appeared with unusual prevalence in Massachusetts in late August and September, and was occasionally observed in Connecticut. It was also reported from Texas and California.

Leaf curl (Taphrina deformans) was reported with the comments indicated from the following States: Massachusetts, about normal, causing very slight damage except in orchards that did not receive the dormant fungicide; New York, less than in an average year; New Jersey, slight infection; Pennsylvania, less than usual; Delaware, more than average, same as in 1935; Maryland, average prevalence, 2 percent reduction in yield; Virginia, the usual amount appeared only where trees were not sprayed; Mississippi, was not observed even in orchards which had not received the dormant spray; Texas, trace; Arkansas, trace, of no importance; Illinois, much less than usual. Michigan, much less, dry in early growing season; Iowa, no injury, unfavorable moisture conditions; Missouri, less than average; Kansas, same as in 1935, much less than in average years; Idaho, less important than usual in Lewiston, very severe in an orchard north of Moscow in July; Washington, commonly observed in western part of State and extending into Skamania County; Oregon, less than last year, probably mostly due to spray applications where the trouble was bad last year; California, less than in 1935 or in an average year.

Rust (Tranzschelia pruni-spinosae). Specimens were received from Texas where the injury was estimated at 0.5 percent. In California where it has been rare since the outbreak in 1928, rust is again assuming importance in some orchards.

Die back (Valsa leucostoma), Texas.

Wilt (Verticillium sp.) was reported from Massachusetts for the first time (P.D.R. 21:56, 89).

Bacterial spot (Bacterium pruni) was of no commercial importance in Massachusetts and was scarcely noticeable even on unprotected back-yard trees. It was more prevalent than usual in Connecticut, causing rather severe defoliation in some young orchards, and appeared in about the usual amount in New York with a slight increase in the number of reports from the Hudson Valley, some of which (at least) are believed to be due to arsenical injury. It appeared much later than usual in North Carolina and was of very little importance. Traces were observed in New Jersey, Delaware, and Illinois. It was very general in Texas where losses were estimated at 3 percent.

Crown gall (*Bacterium tumefaciens*) continues to cause death of old trees in many orchards in North Carolina. It was prevalent in Texas where it was reported from 33 counties causing an estimated damage of 5 percent. It was reported on nursery stock in Idaho.

Root knot (*Heterodera marioni*). In North Carolina heavy losses were observed in orchards recently planted on old fields previously in susceptible crops such as cotton, cowpeas, and melons. Old trees heavily infected were not severely injured. The disease was also reported from Texas.

Virus diseases: Little peach was reported from New York, New Jersey, Pennsylvania, Michigan, and Iowa. For complete summaries of the distribution of mosaic and phony peach, and a brief discussion of the present status of the eradication programs, by B. M. Gaddis, see P.D.R. Supplement 99:36-41 and 45-46.

"X disease", believed to be due to a virus carried in some wild host, possibly *Prunus virginiana*, was reported again from Connecticut where it was found in some new orchards. Yellows was observed in New York causing a trace of loss in six counties; New Jersey; Pennsylvania, loss 0.5 percent; Maryland, 0.5; Virginia, trace; Michigan, less prevalent, 1; Iowa, no commercial loss.

Diseases of non-parasitic and undetermined origin: Yellow chlorosis due to magnesium deficiency was reported from North Carolina. During the extremely dry periods in May and June the leaves of trees in the sand hill region began to turn yellow, from the petiole toward the tip. There was much defoliation but after rains began color was partially recovered and leaf holding improved. (R. F. Poole). E. C. Blodgett reported several types of non-parasitic or undetermined troubles from Idaho (P.D.R. 21:92, 93, 95), including lime-induced chlorosis (also reported from Texas) and another form probably due to excessive irrigation; premature dropping of fruit and foliage, which has increased in severity and prevalence in one locality since it was first observed two or three years ago; shotholing and discoloration of the foliage and dull bark associated with poor growth of trees in a nursery; and a bitter pit type of injury on Lemon Cling fruit from a tree in one orchard. A trouble designated as distal necrosis of the fruit, cause unknown, was reported from Asotin County, Washington. Gummosis was reported from New Jersey. Sunscald was very severe in one planting in Delaware where heavy defoliation had resulted from a late arsenic spray.

Weather injury has been reported in various issues of the *Reporter*.

APPLE. See MALUS SYLVESTRIS.
APRICOT. See PRUNUS ARMENIACA
BLACKBERRY. See RUBUS sp.
CHERRY. See PRUNUS sp.

CITRUS spp:

Canker (Bacterium citri). See P.D.R. Supplement 99:41-43 for a discussion of the present status of this disease by B. M. Gaddis.

CYDONIA OBLONGA. QUINCE:

Leaf blight (Fabraea maculata) caused a loss estimated at 5 percent in Pennsylvania, was also reported from New York and Mississippi. Rust (Gymnosporangium clavipes) appeared in New Hampshire, Massachusetts, Connecticut, and New York. Black rot (Physalospora obtusa) was reported from Massachusetts and New Jersey. Blight (Bacillus amylovorus) was reported as follows: Massachusetts, worse than in most past years; Connecticut; New York; New Jersey, general throughout the State; Pennsylvania, general, more than usual, 5 percent reduction in yield; Texas, 3. Crown gall (Bacterium tumefaciens), New Jersey.

DEWBERRY. See RUBUS sp.

FICUS CARICA. FIG:

Branch canker (Macrophoma fici) was reported from Louisiana for the first time, and from Texas. Several other diseases were reported from Texas, as in previous years.

FIG. See FICUS CARICA.

FRAGARIA sp. STRAWBERRY:

Root rot (Armillaria mellea), Washington.

Gray-mold rot (Botrytis cinerea) was less prevalent than last year in Massachusetts, Connecticut, and New York. In Connecticut it occurred mostly on green fruit. In Louisiana there was less than usual because of the comparatively dry and cool weather during harvesting. It is the most important fruit rot under field conditions in Florida and this year it was favored by cool wet weather in January and February and was much more prevalent than usual, greatly reducing the number of picked berries which could be packed for market.

Anthracnose (Colletotrichum fragariae) although usually one of the most serious diseases in Florida, was almost negligible in 1936. Because of the dry cool spring it did not appear as early as usual and the extremely dry September prevented its spread as rapidly as in normal seasons. (A. N. Brooks).

Leaf blight (Dendrophoma obscurans) was of the usual slight importance in Florida where it very seldom appears in sufficient abundance to warrant control practices.

Leaf scorch (Diplocarpon earliana) was reported as follows: Pennsylvania, usual prevalence, reduction in yield 0.5 percent; Maryland, more, 1.5; Florida, less than usual; Louisiana, less than usual, same as in 1935, 3; Texas, 0.5; Arkansas, trace; Michigan, less than usual, very little, early season dry; Wisconsin, less than usual. A. N. Brooks reports that in Florida this is the only leaf spot that appears in sufficient abundance to make spraying necessary. It is very seldom general, but in individual nursery patches it sometimes assumes major importance.

Slime mold (Fuligo spp.), F. septica in New Jersey; F. violacea in Texas; Fuligo sp. in Kansas.

Root rot (Fusarium orthoceras longius) was more prevalent than usual in Maryland, where it is a very important disease. Wet soil and high soil temperature apparently favored its development. As high as 90 percent infection was observed in individual plantings. The reduction in yield for the State was estimated at 5 percent. (C. E. Temple).

Leaf spot (Mycosphaerella fragariae) appeared as follows: Massachusetts, less damaging than usual on bearing beds but unusually bad on new beds late in the season, loss 1 percent; New York, less than usual, 1 percent; New Jersey, common but cause of little injury; Pennsylvania, usual amount, loss 1 percent; Maryland, 1; Florida, owing to the resistance of the Missionary variety this leaf spot is never of any importance, sometimes appears on shipped-in plants early in the spring but shortly afterwards disappears even though no spray is applied; Mississippi, generally abundant; Louisiana, more than usual prevalence, 10; Texas, 3; Arkansas, trace; Michigan, much less; Wisconsin, less; Minnesota, one report; Iowa, less, 3; Missouri, much less, trace; North Dakota, usual trace; Kansas, much less; Washington, abundant in Cowlitz and Clark Counties, of slight importance in most other western counties.

Fruit rot (Penicillium ubiquitus) which was the cause of much loss in Suffolk County, New York, in 1935 did not occur in 1936.

Fruit rot (Pezizella lythri) was much more prevalent in Florida than usual, but relatively less important than either botrytis or rhizoctonia rot.

Brown core root rot (Phytophthora sp.), California.

Bud and fruit rot (Rhizoctonia solani) were very prevalent in Florida. The cool wet weather favored the development of the trouble. January and February were the wettest in more than 30 years and were also colder than normal. Rhizoctonia fruit rot was almost as abundant as botrytis rot. All rots together reduced the marketable grade of fruit at least 25 percent for the entire shipping season. (A. N. Brooks).

Root rot and crown rot (Rhizoctonia spp.). New Jersey reported a species of Rhizoctonia associated with root rot. Florida reported a crown rot due to a Rhizoctonia sp. definitely not solani. "The species causing this disease in nursery beds is a higher temperature organism working during the summer months, whereas, R. solani causes rot of buds and fruit during cool wet weather. The crown rot was much less prevalent than usual in 1936." (A. N. Brooks). Texas experienced 4 percent loss from root rot attributed to R. solani.

Fruit rot (Rhizopus nigricans). Maryland reported less of this trouble than usual because of the dry hot season, losses were estimated at 3 percent. Florida, with a cool wet season, experienced much more than the usual amount of rhizopus rot which usually does not appear in the field to any extent. Kansas reported 1 percent loss, less than in an average year.

Crown rot (Sclerotinia sclerotiorum) was much less prevalent than last year and less prevalent than in an average year in Louisiana. The loss was estimated at 0.2 percent.

Stem rot (Sclerotium rolfsii) was reported much less prevalent than usual in Florida. The spring and summer months were too dry for its development.

Powdery mildew (Sphaerotheca humuli) was reported from New York, Virginia, Washington, and Idaho, and from California where it was severe on summer and fall crops in Santa Cruz and Monterey Counties.

Wilt (Verticillium spp.) was observed for the first time in Oregon (P.D.R. 20:261) and was reported from California, in Santa Clara, San Mateo, Santa Cruz, Monterey, San Bernardino, Riverside, and Orange Counties.

Black root (various causes). This group of root injuries was reported from the several States designated with causes assigned as indicated: Massachusetts, undetermined, usual prevalence, loss 10 percent; New York; Pennsylvania, several fungus species, usual prevalence, 10; Florida, physiological, "In this condition only the cortex becomes black, the stele remaining white and capable of producing new laterals when the soil about the plant is loosened. Black root appears on plants which have been growing on nursery beds for 6 months or more." (A. N. Brooks); Oklahoma, less than usual, too dry and hot; Michigan; various causes, can be found in many plantings, estimated loss 10 percent; Wisconsin, low winter temperature, more than usual; Minnesota, various fungi, plus winter injury, "Nursery inspectors report much winter injury"; Washington, fungi and winter injury very prevalent in most of the plantings visited.

Dwarf or crimp (Aphelenchoides fragariae). In Massachusetts, where the disease differs in some respects from that in southern States and is thought to be caused by a different physiological strain of the organism, one infected bed was observed in Dighton, the first one outside the Falmouth section of Cape Cod. In the Falmouth section there was marked injury during May but scarcely any symptoms in the fall. The trouble occurred in about the usual amount with losses estimated at a trace. Other reports follow: Maryland, usual scattered distribution, trace, affects certification and sale of plants; Florida, more prevalent, "This disease depends upon previously infested soil and infested sources of plants. Missionary plants from Arkansas still show the need of better inspection so as to prevent distribution. As yet no infested plants have been found in shipments from Maryland"; Louisiana, usual amount, distribution general, 0.5; Texas and Arkansas, trace.

Root knot (Heterodera marioni) was more prevalent than usual in Maryland, where it is being introduced on tomato plants from the South.

Virus diseases: Crinkle was reported from Washington and Oregon. A disease or combination of diseases with symptoms similar to those of crinkle affected berry plantings in several areas in Idaho. Its rapid spread renders a planting unprofitable in one season. Dorsett and Fairfax varieties are commonly affected. (P.D.R. 20:208-209, 234; 21:93). A disease reported as mosaic due to virus appeared in Wisconsin. Yellows was reported as found wherever Marshall and Banner are grown in California.

Variegation (cause undetermined) also known as "suspected mosaic", June yellows, Blakemore yellows, yellow leaf. This trouble which is especially prevalent on Blakemore, but also occurs on certain other varieties, is considered by many to be the expression of a genetic defect, by others to be of virus origin. Reports follow: In New York it was less prevalent. In Maryland, "This is a very important trouble and was more prevalent in 1936, as much as 20 percent in some plantings. The strawberry plant business amounts to twenty to thirty million plants annually, hence the alarm over this new trouble" (C. E. Temple). In Mississippi, "Blakemores have been carefully observed but no 'yellows' has been evident" (Paul R. Miller). In Arkansas, "Very few fields of Blakemore are free. Counts of 15 or 25 percent are not uncommon. It is a serious factor in the Blakemore situation" (V. H. Young). Paul H. Miller reported that certain Blakemore plantings in Arkansas seemed to be free (P.D.R. 21:70-71). In Missouri, "High temperatures resulted in early masking of symptoms and less was evident than usual. We do not know how much injury results. It is present in nearly all Blakemore fields" (C. M. Tucker). In southern Missouri, according to M. A. Smith, "It was severe on June 15 and two weeks later had masked itself making difficult the determination of injury. The problem was further complicated by the fact that the drought killed thousands of plants. It is very difficult to know, under the circumstances, how many plants were killed by 'yellows' and how many by the drought. Undoubtedly the two factors were responsible." In Michigan, "Several plantations of Blakemore were visited. There was less than usual but more than in 1935. The cool fall was favorable for symptom expression. As high as 90 percent of plants showed the disease in some fields." In Minnesota, according to C. J. Eide, "It is still prevalent in fields of the Blakemore variety." In Kansas, "There has been a considerable amount of mosaic or chlorosis, particularly on the Blakemore in the last few years. It is evidently transmissible and spreads rapidly in certain plantings, both by clonal sets and from plant to plant in the field." (C. H. Elmer).

GRAPE. See VITIS spp.
LOGAN BLACKBERRY. See RUBUS sp.

MALUS SYLVESTRIS. APPLE:

Fruit rot (Alternaria sp.), Massachusetts, in storage, less injury than usual; New Jersey, blossom-end rot; Idaho, in scattered plantings near Moscow.

Root rot (Armillaria mellea), Pennsylvania.

Fruit rot (Botrytis sp.), Massachusetts, in storage, less injury than usual.

Leaf spot (Cercospora mali), Texas.

Leaf spot (Coniothyrium pyrinum), Illinois, on nursery stock.

Leaf spot (Corticium stevensii) was abundant in mountain sections of North Carolina, especially at elevations of 1,500 feet or over.

Sooty blotch (Gloeodes pomigena), Connecticut, less than in 1935; New York, in general very little, one severe case in Westchester County; New Jersey, very severe in orchards where late summer sprays were omitted; Pennsylvania; Delaware, more than in 1935, very prevalent on late harvested fruit of Grimes and Jonathan varieties; Maryland, same as in 1935, less than usual; West Virginia, less than in an average year; North Carolina, abundant on unsprayed fruit, not important in sprayed orchards.

Perennial canker (Gloeosporium perennans). J. R. Kienholz reported "Moderate reinfection in the Hood River section of Oregon at higher altitudes where heavy freezes occurred, directly correlated with wooly aphid or mechanical injury in respect to freezing damage and subsequent canker infection. The fruit rot was more serious than usual. The reason is difficult to explain since rains in June appeared to be the only ones sufficient to promote infection." The disease was reported from Idaho also.

Bitter rot (Glomerella cingulata). Massachusetts, "Rarely seen in the orchard and of little consequence in storage"; New York; New Jersey, "In a limited number of orchards this disease was very destructive, especially on Jonathan, Stayman, Rome, and Winter Banana varieties. Losses as a whole, not very serious"; Pennsylvania, less than usual, trace; Delaware, "A trace in commercial plantings on Jonathan"; Maryland, usual amount, 2 percent loss in storage; Virginia, "Less than usual, summer rather dry"; West Virginia, "Less, only a trace occurs locally, mostly in the Ohio River Valley, especially on Mother, Willow Twig, and Ben Davis"; North Carolina, "Abundant, causing severe losses in unsprayed orchards. Bordeaux has not given good control in some instances." (See also P.D.R. 20:357-358); Texas, trace; Arkansas, not seen; Wisconsin, not seen nor reported; Iowa, no loss.

Quince rust (Gymnosporangium clavipes) was reported as follows: Massachusetts, "About the same amount as usual on Delicious and Gravenstein varieties"; Rhode Island, "Very heavy infection in a large block of Wealthy"; New York, "Usual slight importance, trace of loss"; Pennsylvania, "As usual, slight amount"; Illinois, "Much less than in 1935, seen in one orchard of Willow Twig, 20 of 100 trees with 0.2 percent of the fruit affected." (See P.D.R. 20:180).

Hawthorn rust (Gymnosporangium globosum), Massachusetts; New York.

Apple rust (Gymnosporangium juniperi-virginianae. See also Gymnosporangium spp.). Massachusetts, "Decidedly less on Winter Banana and Wealthy varieties than in most years, less than usual generally"; Connecticut, "Prevalent on susceptible varieties, medium to light infection on leaves"; New York, "Rather more prevalent than usual. Fairly severe but little fruit infection except in Rockland and possibly Orange counties"; New Jersey, "General, severe in most regions. Occurred on foliage and fruit in practically all orchards in Passaic County"; Pennsylvania, "As usual; apple rust and quince rust together caused 0.5 percent loss"; Delaware, less than in 1935, average amount; Maryland, "Generally more prevalent than in average years." See also P.D.R. 20:180; North Carolina, "Very abundant and caused severe damage in piedmont and mountain areas where both cedar and apple are common"; Illinois, "Heat and drought unfavorable, less than usual, general loss 2 percent; more in southern Illinois."; Minnesota, usual slight prevalence, too dry and hot for much injury, 0.5 percent loss; Missouri, "As in 1935 the disease assumed no commercial importance; drought and high temperatures unfavorable to fungus; loss less than 0.1 percent"; Kansas, "Much less than in an average year."

Rusts. Gymnosporangium spp. (probably mostly G. juniperi-virginianae) were reported from New Hampshire; Virginia, "More than usual; frequent showers very early in the season; loss 2.5 percent. Northwestern Greening immune, York very susceptible."; West Virginia, "Less than usual or last year, loss 1 percent. Northwestern Greening immune, Stayman very resistant, York, Ben Davis, Rome Beauty susceptible. During the winter of 1935-36 widespread cedar eradication was carried out, with evident results"; Arkansas, trace; Michigan, "Generally much less than usual or last year; dry in early part of season. Apple trees near a cedar grove near Flint were reported severely infected"; Iowa, "Mostly less than usual, but more reported in Polk, Scott, and Mills counties. Loss 1 percent."

Fly speck (Leptothyrium pomi) was reported from New Hampshire, New York, New Jersey, Pennsylvania, Maryland, North Carolina, and Wisconsin in the usual amounts or less, and in no instance assuming commercial importance.

Surface bark canker (Myxosporium corticolum) was again prevalent in New Jersey. Delicious, Jonathan, Twenty-Ounce, Winter Banana, and Winesap are reported to be susceptible.

Anthracnose (Neofabraea malicorticis) was observed to be very destructive in some orchards in western Washington. In the Hood River district of Oregon new infections were very rare. Apparently the early freeze in the fall of 1935 and earlier lack of rain prevented reinfections.

Blister canker (Nummularia discreta). From Missouri, M. A. Smith writes: "I have reported 10 percent loss due to blister canker for southwestern Missouri. It is difficult to say whether many of the trees this season died because of blister canker alone or whether the drought was partly responsible. Apparently the two factors were involved." Blister canker was also reported from New York and Kansas.

Fruit spot (Mycosphaerella pomi [Phoma pomi]) was, as usual, of little importance in the area from which it was reported, from Massachusetts to West Virginia.

Fruit rot (Penicillium expansum and Penicillium sp.). Massachusetts, less than usual; New York, 2 percent loss in storage; Pennsylvania, usual amount, 1; Texas, 2; Washington, lenticel infection. The first two States named did not designate the species.

Fruit rot (Phoma sp.), Washington.

Blotch (Phyllosticta solitaria) was generally reported as less to much less prevalent than usual and caused slight loss, the only estimates of more than a trace being 4 percent in Texas, 1.5 in Pennsylvania, and 0.5 in Iowa. Dry hot weather was given as the reason for the reduced amount of disease in Virginia, and for the very slight loss in several states where blotch is ordinarily of some importance, including Oklahoma, Arkansas, Illinois, and Missouri. In Arkansas, heavy leaf infection occurred on susceptible varieties in October. Because of a spring freeze most orchards had not been sprayed during the summer and September rains furnished very favorable conditions for blotch infection. In Illinois more leaf infection was observed than is usually the case. Two cases on McIntosh in Wayne County, New York remained quiescent. (P.D.R. 20:180, 355, 358; 21:24, 27).

Root rot (Phymatotrichum omnivorum). This disease was reported from Nevada for the first time by C. J. King, in the Moapa and Virgin River Valleys, where it had probably been present for a long time (P.D.R. 20:202). It was also reported from Texas as usual.

Black rot (Physalospora obtusa). Massachusetts, "Both the leaf spot and the post-harvest fruit infection appeared to be worse than usual, canker stage about the same"; New York, "Less than in 1935, slight infection in the Hudson Valley, traces in western New York"; New Jersey; Pennsylvania, 3 percent reduction in yield plus 1 percent storage loss; Delaware, "More than usual, very general as a blossom-end rot on the Williams variety"; Maryland, usual amount, 1.5 percent; Virginia, "Less, owing to low rainfall"; West Virginia, "Less than usual, trace, usually follows spray injury or codling moth injury"; North Carolina, "Practically none on fruit but serious on leaves especially where summer sprays were omitted"; Texas; Arkansas, trace; Illinois, "Less than in 1935, more than in average years, reduction in yield 1 percent, loss from fruit rot 2 percent. Leaf spot has been more generally observed during the past three or four years"; Wisconsin, trace; Iowa, "Less, 1 percent"; Kansas, much less; Washington.

Powdery mildew (Podosphaera spp.). Powdery mildew reported as P. leucotricha occurred in New York, Minnesota "Only on some seedlings from the Pacific Northwest; too hot for it to become important.", Washington, and California. P. oxyacanthae was said to be very abundant in New Jersey and severe on some trees. Delaware and West Virginia also reported powdery mildew, species not given, in less than the usual prevalence.

Root rot (Rosellinia /Dematophora/ necatrix) was observed in Santa Cruz County, California.

Brown rot (Sclerotinia fructicola) was reported only from New Jersey.

Silver leaf (Stereum purpureum) was reported from New York in an orchard at Ithaca (P.D.R. 20:275) and a few new cases were observed in the Hudson Valley. The infected trees in western New York which developed fruiting bodies in 1935 developed none during the dry season of 1936.

Scab (Venturia inaequalis). Of the twenty-five States throughout the country from New England to California reporting on apple scab only Massachusetts reported its presence in more than average severity and most reported less or much less than in average years. The dry weather during or following the usual periods for infection prevented development. Some typical reports are quoted as follows: Massachusetts, "Worst scab year since 1931. Difficulty or failure to get a spray on prior to May 3-4 rain caused the heavy primary infection. Leaves expanded very rapidly during April 29 to May 2 so that those orchards sprayed prior to May 1 were not protected against the rain of May 3-4. Failure to burn out the primary leaf spots at the first cover spray contributed to the heavy secondary spread." Connecticut, "Usual amount. Infection period worst about May 3 to 4." Virginia, "Less than usual and much less than last year; occurred mostly in low locations and in wet orchards. The spring from early April was dry and warm, with showers of only short duration. The spore carry-over was the heaviest in years but the threatened outbreak failed to develop because of unfavorable dry weather." West Virginia, "Less, insufficient rains in May. Unsprayed Staymans, Ben Davis, and Winesap had 93, 95, and 98 percent but the disease was easy to control. Nearly perfect control was obtained in spraying experiments." Kentucky, "Much less, moderately dry during blooming period. Severe scab on the foliage in 1935 seemed to have been one cause of poor bloom on some varieties in 1936." North Carolina, "Severe, especially on young fruit. Early infection resulted in short crops throughout the State." Arkansas, "Difficult to find scab lesions on foliage in 1936; in spite of heavy carry-over." Illinois, "Much less, very dry and hot throughout season." Michigan, "Less than usual, much less than last year. Dry during prebloom and until late summer. Sepal infection occurred in the green-tip stage, the critical time to spray. Dry weather prevented secondary infection. In the late fall much foliage infection was seen throughout the State." Missouri, "Much less than last year. In contrast to 1935, when scab was unusually prevalent, in 1936 scab was almost non-existent throughout Missouri. 1936 was the driest year of record. High temperatures throughout spring and summer checked the spread of the disease." Washington, "Scab was fairly abundant in all counties west of the Cascades." Oregon, "Only a trace was found in the Hood River Valley this year. There was no carry-over from last year and sprays were applied on time."

Blight (Bacillus amylovorus). Twenty-four States reported on blight. In the East, Vermont, Delaware, and Maryland reported less or much less than usual, while Massachusetts, Connecticut, New York, Pennsylvania, Virginia, West Virginia, and Mississippi reported more or much more than in an average year and New Jersey recorded the disease as general. Arkansas reported the least at any time since records have been kept, associated with almost complete killing of blossoms by a late freeze and drought. See P.D.R. 20:195-196. Illinois, Wisconsin, Minnesota, Iowa, and Kansas each reported less than usual. Other states reporting its presence are North Carolina, Texas, Michigan, North Dakota, Wyoming, Colorado, Idaho, and California.

Crown gall (Bacterium tumefaciens). Reports were received from nine States but no significant change was noted from conditions previously recorded.

Hairy root (Phytomonas rhizogenes), Idaho, in nursery stock.
Mosaic (virus), New York, scattered, no new cases.

Variegation (cause unknown, apparently infectious, ? virus). Tucker in Missouri reported that at Versailles, Morgan County, eight or ten Jonathan trees fifteen years old were affected with an apparently infectious variegation not described more fully.

Aerial galls (non-parasitic), Washington.

Bitter pit (Baldwin spot, stippen; non-parasitic) was reported in the region from New England to North Carolina; and from Wisconsin. In North Carolina it was said to be severe throughout the State on heavily loaded trees following the June drought, and caused more damage in the western part than it had caused during the previous five years. Maryland and New York also reported more than usual.

Chlorosis (non-parasitic, lime-induced) is very severe and is increasing both in severity and distribution in southern Idaho. It was also reported from Texas.

Cork (non-parasitic) was reported from four States as follows: Massachusetts, "More internal cork than in past years. Dry weather during early to mid-season seems to bring it on"; New York, "More prevalent locally in certain orchards. The prevalent form was a late-season, diffuse browning of flesh, previously shown to be preventable by irrigation. Always erratic, cork occurred in the Lake Ontario and Hudson Valley districts this year. It was practically absent from the Champlain Valley where it occurs more frequently. Its absence there this year was due to the absence of drought." Virginia, "More prevalent than usual. Ben Davis and Gano varieties suffered a loss in grade of 10 percent. Cork was also prevalent on Northwestern Greening and York varieties"; West Virginia, "One case of 100 percent loss on Dutchess was caused by cork."

Drought spot (non-parasitic). New York reported less drought spot than usual with other comments as follows: "Noted only in Clinton, Essex, and Columbia Counties. Favored by drought in June. No acute drought occurred in those areas where drought spot is prevalent most years. Favored by heat in late June or early July. The heat wave came too late. Drought spot refers to external, superficial lesions. Cork (see report above) refers to internal lesions." Drought spot was also reported from Washington.

Jonathan spot (non-parasitic), New Jersey, Idaho.

Rosette (non-parasitic, due to boron deficiency) was less troublesome in the Champlain Valley of New York than usual, owing to sufficiency of moisture. This disease has been experimentally controlled with boron. Tolman Sweet is very resistant, McIntosh and Fameuse are susceptible.

Spray injury (various spray materials). Connecticut, New Jersey, and West Virginia each reported little spray injury. F. J. Schneiderhan wrote that in West Virginia generally favorable spray weather reduced the losses from spray injury in 1936. "Experimental spraying shows that spray injury can be caused by all spray materials at any time during the growing season." In New York, conditions were less favorable as is apparent from the following excerpts from reports: "Record breaking heat wave in July caused the most severe leaf scorching in a decade. Wettable sulfurs caused serious scorching for the first time in this State. Most general in western New York." "Spray injury from oils applied in the delayed dormant is common." May 2. Copper injury was less prevalent. No copper was used in the Hudson Valley. Slight injury in most orchards where used in western New York. One severe case in Madison. (Cooler, more fogs, etc.)." Arsenical injury was less prevalent in western New York than in 1935 and in the Champlain Valley about the same.

Weather injuries: Frost injury (spring frosts). New York reported 20 percent reduction in yield and banding and russeting of fruit amounting to an additional 5 percent loss in grade with a maximum incidence of 100 percent. The primary frost injury was also augmented by sulfur sprays prior to the July heat wave and in late season by copper sprays. Frost injury also occurred in Connecticut. Frost bands on fruit in Idaho. Hail injury from a storm on March 23 was severe in the Missouri Ozarks, both to fruit buds and the trees themselves. It was also reported from New York. Sun scald: New York, "Sun scald of apples on the southwest portion of the tree in particular is occurring following the heat" (July); Delaware, "Week of June 13 associated with severe sun scald of fruit and foliage"; Minnesota, sun scald attributed to cold early in the spring or late winter was reported as, "by far the most prevalent disease of apples this year". Winter injury (low temperature): Massachusetts reported the usual amount and noted that some of the trees surviving after the severe 1933-34 winter succumbed during the drought of the summer of 1936. New York also reported the loss of trees originally injured in 1933-34. Killing of blossom buds by the January freeze was reported from Kentucky. Arkansas estimated 75 percent reduction in yield due to winter freeze and extreme drought. Illinois and Wisconsin both experienced severe winter injury and Washington reported twig-blight and die-back from the same cause.

PEACH. See AMYGDALUS PERSICA
PEAR. See PYRUS COMMUNIS
PLUM. See PRUNUS spp.
PRUNE. See PRUNUS DOMESTICA

PRUNUS ARMENIACA. APRICOT:

Among others, the following diseases were reported: Blight (Coryneum beijerinckii), Washington, Idaho. Brown rot (Sclerotinia cinerea) was much less prevalent than in 1935 in northern California in spite of the fact that rains occurred during the blossom period. Brown rot (Sclerotinia fructicola), Texas. Green rot (Sclerotinia sclerotiorum) was much less important than usual in California. Rust (Tranzschelia pruni-spinosae) did some damage to fruit in Tulare County, California. Bud blight and gummosis (bacterial): Serious twig injury caused by a green bacterial organism occurred in an orchard in Santa Clara County, California. Mosaic mottle (virus?), Chelan County, Washington. Double fruits (non-parasitic), Idaho. Silvering and necrosis of leaves, cause unknown, Idaho (P.D.R. 21:44).

PRUNUS DOMESTICA. PRUNE:

Root rot (Armillaria mellea): The first known case in Kern County, California, was observed in February, on prune grafted on Myrobalan stock. Leaf spot (Coccomyces prunophorae) occurred in nurseries at Shenandoah, Iowa. Blight (Coryneum beijerinckii) caused considerable spur and limb killing in Clark County, Washington. Black knot (Plowrightia morbosa) was prevalent in practically all New York prune orchards and was severe in a few where infection developed in 1935. Root rot (Poria sp., ?ambigua), California (see cherry). Brown rot (Sclerotinia fructicola), Washington. Rust (Tranzschelia pruni-spinosae), Washington. Crown gall (Bacterium tumefaciens) was important in an orchard in Idaho (P.D.R. 21:91). Mottle (virus), Washington. Gum pockets (undetermined, may be non-parasitic or virus), Washington (P.D.R. 20:234). Russetting (low temperature), Washington. Various non-parasitic and undetermined troubles were reported from Idaho. (P.D.R. 21:92, 94).

PRUNUS spp. CHERRY:

Leaf spot (Coccomyces hiemalis). As with apple scab and for the same reasons, in contrast to 1935, leaf spot did comparatively little damage in 1936. Of the fourteen States reporting its presence, eleven stated it was less or much less prevalent than usual because of dry hot weather. New Jersey reported it as severe in some orchards causing defoliation, and Maryland estimated 3 percent injury with the usual prevalence. In Michigan there was little development until late fall and the late infection this year caused little damage. Last year the disease was so severe that many trees died.

Blight (Coryneum beijerinckii) was reported from Idaho on sweet cherry and for the first time on the wild cherry, Prunus emarginata. It was unusually prevalent on both sweet and sour cherries in western Washington. In the Hood River Valley of Oregon three Napoleon cherry trees next to a peach orchard showed fruit spotting but none on the twigs.

Root rot (heart rot, Poria sp., ?ambigua) was more important than usual in Sacramento County, California, where it caused heavy loss of entire trees in a few scattered orchards subjected to overflow from a creek. It is apparently not an aggressive disease in an average year. It was found on prunes in a number of other counties.

Brown rot (Sclerotinia fructicola) was generally less or much less severe than in an average year owing to dry weather. Massachusetts estimated an average 10 percent loss with some orchards running much higher. In western Washington about the usual prevalence was noted. Elsewhere losses were below the average. Both S. cinerea and S. fructicola were reported from Washington. Sclerotinia sp. caused 40 percent loss in the Hood River Valley of Oregon, where three rainy periods from the last of May until June caused considerable splitting of the fruit while the fruit was still green, which was unusual. High humidities accompanied the rainy periods and the moisture was rapidly absorbed by the fruits. Brown rot was severe on such lots. Sclerotinia sp. was important, as usual, in California.

Scab (Cladosporium carpophilum) was abundant on sour cherries in Washington. It is an unusual disease on any host in that region. Black knot (Plowrightia morbosa) was prevalent in New York, New Jersey, and mountain areas of North Carolina. Powdery mildew. Podosphaera sp. was reported on sweet and sour cherries in Idaho (P.D.R. 21:90). P. oxyacanthae was much less prevalent than usual in New York. Silver leaf (Stereum purpureum), New York, New Jersey. Witches broom (Taphrina cerasi), Washington and Oregon. Leaf curl (Taphrina sp.), North Carolina on wild cherry only.

Bacterial spot (Bacterium pruni) was scarce in New York, and observed in New Jersey and Texas where losses were negligible.

Virus diseases: Mosaic or crinkle was reported from Pierce County, Washington. Mottle leaf was reported from Chelan County, Washington, Hood River County, Oregon, where it was discovered on four trees and identified by budding last year, and in California where it was first recognized in 1935 and is known to exist in four orchards in three counties. According to J. R. Kienholz the disease apparently does not spread rapidly under Hood River, Oregon conditions, but it reduces the yield of affected trees 80 percent and that produced is inferior in size and flavor so that the disease is potentially a serious one. What was thought to be this disease, although the diagnosis is uncertain, was also reported from Lewiston, Idaho (P.D.R. 21:95).

Weather injury (low temperature and drought). Winter injury was again severe in Massachusetts. The after effects of the severe winter of two years ago continued to appear in New York though no new cases reported. Arkansas suffered 33 percent loss from freezing and drought and in Wisconsin where the loss was set at 75 percent, the canning company at Sturgeon Bay did not operate because of the low crop. Most of the blossoms were killed during a 39 day period when the temperature registered below 0° F. In Kansas many trees died from drought and Washington reported winter injury to trees and fruit necrosis due to cold.

PRUNUS spp. PLUM (See also P. domestica, prune):

Leaf spot (Coccomyces prunophorae) was less prevalent than usual in New York. This was also true in Kansas but in that State scarcely any trees have survived the heat and drought of the past few years.

Black knot (Plowrightia morbosa) was destructive in home plantings in Massachusetts but much less important in commercial orchards. It was reported from Connecticut. It is increasing in commercial plantings in western New York. It was common in New Jersey and reported in the usual, or less than the usual, prevalence in Pennsylvania, Maryland, West Virginia, Texas, and Wisconsin, but was not observed in North Dakota.

Brown rot (Sclerotinia fructicola). Of the twelve States reporting on brown rot only one, Maryland, reported more than the usual prevalence. In North Carolina it caused severe losses on most varieties. Massachusetts and Pennsylvania estimated the usual prevalence. Elsewhere it was of no material importance or less common than usual.

Scab (Cladosporium carpophilum) appeared in traces in Wisconsin. Rust (Tranzschelia pruni-spinosae) was common in Texas. It caused premature defoliation in several localities in southwestern Washington, where it had not caused noticeable injury previously. Plum pockets (Taphrina pruni) appeared in New York, Texas, Wisconsin, Minnesota, and North Dakota, but was of comparatively little importance. Die back (Valsa leucostoma), New Jersey and Texas. In New Jersey root infection by this organism caused death of trees (P.D.R. 20:239). Bacterial spot (Bacterium pruni) appeared in traces in Maryland, Texas, Wisconsin, and Missouri. Drought spot (nonparasitic) was reported from New York.

PYRUS COMMUNIS. PEAR:

Leaf blight (Fabraea maculata) was much more prevalent than usual in Delaware where unsprayed trees were 80 percent defoliated by September and fruit infection was abundant. The disease was also more prevalent than in average years in Louisiana where it was observed only in the southeastern part of the State. On the other hand it was less or much less common than usual in Pennsylvania, Maryland, and Missouri. Leaf infection was negligible in Missouri. Fabraea cankers had been found on Kieffer and Garber water sprouts and twigs in 1935. A very few new infections were found on wood in 1936. The usual trace of injury occurred in New York. The disease was reported from New Jersey, and from Illinois on nursery stock.

Leaf spot (Mycosphaerella sentina) was severe on sand pear (Pyrus serotina) in Mississippi causing considerable defoliation. Traces appeared in New York and Texas. It was not observed in Kansas.

Scab (Venturia pyrina). Twelve States reported the presence of scab but it was relatively unimportant and less prevalent than usual except possibly in western Washington where it was recorded as "rather abundant" in all counties. J. R. Kienholz reporting from the Hood River region of Oregon, writes, "Only a few cases of serious infection this year. This is almost totally due to lack of twig infections last season and late ascospore maturity this spring when sprays had already been applied. It has been our experience that scab is readily controlled by a fair spray program when twig infections are lacking but becomes very difficult when they are present." In California the disease was said to be important in 1936 only where little or no spraying was done.

Blight (*Bacillus amylovorus*) was on the whole more prevalent than usual in the Eastern States. Massachusetts, Connecticut, New Jersey, Pennsylvania, Maryland, Mississippi, Illinois, and Michigan each reported more or much more than usual. New York reported more in some counties and less in others and even within counties the distribution was localized. Virginia among the Eastern States, and Arkansas, Wisconsin, Iowa, Kansas, Colorado, Oregon, and California reported less than usual. Louisiana, Texas, and Minnesota each observed the usual prevalence. In Idaho the disease was locally very severe. Some comments by reporters are: Michigan, "Pear growers somewhat alarmed at amount of blight showing up late in season." (D. Cation). Hood River, Oregon: "No infections were found this year after the outbreak of last season. The efficient eradication program and environmental conditions undoubtedly are responsible for its absence." (J. R. Kienholz). California: "A succession of relatively unfavorable years have reduced the disease considerably. However, a few orchards suffered moderate to severe losses." (H. Earl Thomas).

Crown girdle (*Dothiorella* /*Botryosphaeria*/ sp.), Southeastern Louisiana. Sooty blotch (*Gloeodes pomigena*), Connecticut, one report. Black rot (*Physalospora obtusa*) was reported only from New Jersey and Texas in traces. Brown rot (*Sclerotinia* sp.), Washington.

Blast (*Phytomonas* sp., a green fluorescent organism) was reported as occurring in three counties in California. In one case large branches of the Old Home variety were affected.

Black end (non-parasitic), Idaho. Drought spot or cork (non-parasitic), New York.

RASPBERRY. See RUBUS spp.

RUBUS spp. CANE FRUITS:

On BLACKBERRY, besides various diseases reported about as usual, the following were reported: Gray mold (*Botrytis cinerea*) was much more prevalent in Massachusetts than usual. Dr. Davis wrote that he had never seen so many diseased berries on the canes before and they were covered with the gray mold. The reduction in yield was estimated at 50 percent. Distribution was scattered. The mold occurred in New Jersey but was of little importance. Anthracnose (*Elsinoe veneta*) was more prevalent than usual in Massachusetts where it is increasing in severity in old plantations. Its effects were aggravated by dry weather and it caused a heavy loss of plants, estimated by Davis at 50 percent. The disease was not important in other States reporting. Witches' broom (virus) was found for the first time in Pennsylvania, in Lancaster County.

Reports on diseases of DEWBERRY indicate little change from previous years.

On the LOGAN BLACKBERRY, dry berry (Haplosphaeria deformans) was reported from Oregon. See P.D.R. 20:209. Leaf spot (Mycosphaerella rubi) developed destructively in western Washington. (P.D.R. 20:231). Mosaic (virus) was reported from Idaho.

On RASPBERRY the following diseases were reported:

Gray mold (Botrytis cinerea) was common in New Jersey.

Spur blight (probably Didymella applanata although often reported as Mycosphaerella rubina) was present in New Hampshire; Massachusetts, less than usual, 4 percent loss; New York, about the usual severity; New Jersey, reported as very severe in some localities; Pennsylvania, less than in 1935, the usual trace; Texas; Minnesota, not important; Iowa, less than usual, a trace; Colorado, more than in 1935 and much more than usual, estimated reduction in yield, 15 percent; Washington.

Anthracnose (Elsinoe veneta) was recorded from twelve States. Maryland and Iowa each reported more than usual with losses set at 6 and 7 percent respectively. Massachusetts, where the destruction was confined to an occasional black-raspberry patch, New York, Texas, Wisconsin, Minnesota, and Kansas each stated the trouble was less prevalent than usual. In North Carolina it was severe and caused heavy losses in the mountain areas. It occurred also in New Jersey, Pennsylvania, and in Washington State where it was present in moderate amounts on black raspberries.

Orange rust (Gymnoconia peckiana) was observed over the usual range in about the same or slightly less prevalence than in 1935.

Cane blight (Leptosphaeria coniothyrium) was generally of the usual prevalence or less.

Leaf spot (Mycosphaerella rubi) was of little importance, as usual, in States reporting.

Western yellow rust (Phragmidium rubi-idaei) was prevalent but generally less severe than usual in Washington. It also occurred in Vermont.

Yellow late rust (Pucciniastrum americanum) was reported from New York by L. M. Cooley, as follows: "Late rust is fairly common all over the State and more serious in the Adirondack section. On red raspberry it has become increasingly prevalent in the last few years and was especially common this fall on the Latham variety in the Hudson Valley. The economic loss from autumn rust in raspberries is ordinarily negligible, but a few instances have been observed where premature defoliation in mid-September predisposed the canes to winter killing. High humidity and poor air circulation or drainage favors the disease sometimes where infections have been heavy so that the under surfaces of the leaves were completely covered with the rust pustules. Growers have mistaken this for the systemic orange rust disease." The disease also appeared in Wisconsin but with less than usual severity.

Powdery mildew (Sphaerotheca humuli) was economically serious on the Latham variety throughout the Hudson Valley in New York. Since sulphur products can not be used on raspberry foliage there is need of a milder fungicide to control the disease. This mildew was also present in New Jersey, Pennsylvania where it was more prevalent than usual and serious in some fields, and Idaho.

Blue stem (Verticillium albo-atrum) appeared in occasional plantings in New York, New Jersey, and Washington.

Crown gall (Bacterium tumefaciens) continues to be important and constitutes a major problem in some States. There were no significant changes in the situation during the year.

Leaf curl (virus) was less prevalent in western New York and more prevalent in the Hudson Valley than in 1935. Pennsylvania, Maryland, and Wisconsin estimated about the same prevalence as in 1935. No reports of its presence were received in Minnesota this year. It was reported in Idaho.

Mosaic (virus) continues to be a factor of importance. It was reported as follows: Massachusetts, 20 percent loss, usual prevalence; Connecticut; New York, more prevalent than heretofore, the basic trouble is thought to be the extreme abundance of cultivated infection sources especially in the Hudson Valley, see P.D.R. 20:260-261; New Jersey; Pennsylvania, same as in 1935, 6 percent loss, less than average prevalence; Wisconsin, less prevalent; Minnesota, disease is growing more scarce in nurseries due to rogueing, 10 percent reduction in yield; Iowa, less, 7; North Dakota, generally distributed; Kansas, practically none seen, most red raspberries dead due to drought; Washington, prevalence increased, see P.D.R. 20:231, 21:11; Idaho, mild to severe injury in nearly every planting visited in southern Idaho. See P.D.R. 20:123-125 for a discussion of English mosaic in Oregon.

Streak (virus) reported from Pennsylvania as "the most dreaded disease in the State" was less prevalent than in 1935. Loss was estimated at 7 percent.

Weather injury. New York experienced much less winter killing than usual with none reported, but in Minnesota the combination of drought and winter cold resulted in much more loss than usual. In one large field examined the canes were browned and yielded nothing because of the combined effect of drought and winter injury. Loss estimated at 5 percent for the State.

On YOUNGBERRY (and other Hybrid Dewberries): Leaf spot (Cercospora rubi), Mississippi, abundant in plantings in the coast region. Anthracnose (Elsinoe veneta) was found on young canes in Mississippi. In Washington it occurred on Boysen berry and on Olympic berry as well as on Youngberry. Dry berry or blossom blight (Haplosphaeria deformans), Oregon, first report in the United States. (P.D.R. 20:209). Leaf spot (Mycosphaerella rubi) developed destructively in western Washington. Crown gall (Bacterium tumefaciens), Washington, on Boysen berry.

STRAWBERRY. See FRAGARIA sp.

VITIS sp. GRAPE:

Dead arm (Cryptosporella viticola) occurred in New York, West Virginia, rather commonly on Concord in Van Buren County, Michigan, and was very important in the American River District of Sacramento County in California on the varieties Olivette Blanche, Cornichon, and Tokay.

Anthracnose (Elsinoe ampelina) appeared in New Jersey, Maryland, North Carolina, Florida, and Texas in about the usual prevalence. Losses were not serious.

Black rot (Guignardia bidwellii). Of the seventeen States reporting only Maryland and Florida estimated prevalence above average. Losses estimated were 1 percent in Wisconsin, 2 in Massachusetts, 8 percent in Maryland, 25 percent in Florida, and 40 percent in Texas. It was common in New Jersey and in some cases caused heavy loss. In general it was less or much less destructive than in average years being held in check by dry weather.

Bitter rot (Melanconium fuligineum) caused about the usual injury in Florida where reduction in yield was estimated at 5 percent with a like amount of loss in quality.

Root rot (Phymatotrichum omnivorum) was reported for the first time from Nevada, where it apparently had been present for many years in the Moapa and Virgin River Valleys, according to C. J. King. (P.D.R. 20:202).

Downy mildew (Plasmopara viticola). Losses from this disease were generally less than usual being confined to a trace in most of the eleven States reporting its presence. Only in Maryland was the prevalence above average. Losses were set at 2 percent in Maryland and 10 percent in Texas.

Powdery mildew (Uncinula necator) was noted in Massachusetts, Connecticut, New York, Virginia, Texas, and California. Only in New York was an increase in prevalence reported.

Weather injury (cold and drought). New York reported the usual amount of winter injury but Iowa suffered much more than usual with reduction in yield estimated at 30 percent. Arkansas estimated 10 percent loss from frost and drought and Washington reported "corky center" due to drought.

Non-parasitic. Various non-parasitic or undetermined conditions were reported as follows: Bronzing (undetermined) from Texas. Chlorosis due possibly to lack of iron from one locality in Minnesota. The vines seemed to respond to spraying with 0.2 percent ferrous sulphate. Lime-induced chlorosis caused severe damage and is increasing in severity and distribution in southern Idaho, also reported from Texas. Leaf necrosis due to nutritional disturbance, Washington. Shelling (undetermined), New Jersey, common in some vineyards.

YOUNGBERRY. See RUBUS sp.

## D I S E A S E S   O F   N U T   C R O P S

Few reports were received on diseases of nut crops in 1936. Diseases of pecan, *Hicoria pecan*, were so incompletely reported that this host is omitted. For chestnut see *Castanea dentata* under Trees and for peanut *Arachis hypogea* under Special Crops.

### AMYGDALUS PERSICA. ALMOND:

Blight (*Coryneum beijerinckii*) and brown rot (*Sclerotinia cinerea*) occurred in California in about the usual amounts.

### CORYLUS spp. FILBERT, HAZELNUT:

A summary of diseases in the Pacific Northwest in 1936, by Paul W. Miller, was given in the Reporter (P.D.R. 21:7-8). The only additions are root rot (*Armillaria mellea*) and blight of the nuts due to sterility both reported from Washington.

### JUGLANS REGIA. PERSIAN WALNUT:

Diseases of Persian walnut in the Pacific Northwest were also reported by Miller. Additional reports are as follows (for butternut, *J. cinerea*, and black walnut, *J. nigra*, see under Tree Diseases):

Root rot (*Armillaria mellea*) was reported from California on *Juglans hindsii* used for root stock in a Persian walnut orchard in Tulare County. It was said to have been present for fifteen years and was killing the trees very slowly. On one tree the fungus had advanced three feet above the ground line into the Persian walnut trunk. (C. E. Scott). The disease was also reported from New Jersey.

Anthracnose (Glomerella cingulata), Texas. Leaf spots (Gnomonia juglandis and G. leptostyla), New Jersey. Die back, caused by winter injury plus Nectria sp., was reported from Washington. Root disease (Phytophthora cambivora): Persian walnut was found to be affected in Maryland, according to Bowen S. Crandall (P.D.R. 20:202-204). Bacterial blight (Bacterium juglandis), New Jersey and Texas.

## DISEASES OF VEGETABLE CROPS

### ALLIUM CEPA. ONION:

Neck rot (Botrytis allii) was of minor importance. In New York it caused 2 or 3 percent loss but with the gradual improvement in storage houses the injury done is being reduced, although still large. It was too dry in Wisconsin this season to permit much neck rot. Leaf blight (Botrytis sp.) did some injury in Massachusetts and was very damaging to a large planting in Clark County, Washington. It occurred also in California.

Bulb rot (Fusarium oxysporum f. 7 /F. cepae/) caused important losses in New Jersey. Bulb rot (Fusarium vasinfectum var. zonatum f. 1) developed in about the usual amount in Iowa and Colorado. Losses were set at 2 percent and a trace respectively. Texas reported a trace of bulb rot and Oklahoma less than the usual amount of neck rot, in each case attributed to Fusarium, species undesignated.

Pink root (reported as due to Fusarium solani /F. malli/) was reported from Connecticut; Mississippi, on a field planted with Texas-grown sets; and Texas where prevalence was estimated at 7 percent. The disease was not observed in North Dakota this year. Pink root (Phoma terrestris). From a trace to 1 percent appeared locally in New York. Iowa reported 3 percent loss, Colorado a trace locally, and New Mexico more or less serious prevalence.

Black mold (Macrosporium spp.) caused slight injury in Massachusetts; New York, "Following various injuries and especially on stems of seed onions"; Texas; and Washington. Purple blotch (Macrosporium porri) was reported from the Rocky Ford District in Colorado. According to Henry A. Jones it was observed also in Maryland, South Carolina, and Louisiana.

Downy mildew (Peronospora destructor) was less prevalent than it had been in 1935 in Massachusetts, New York, where there was almost none because of the extremely dry hot season, and California. In Pennsylvania there was the usual slight amount. It was also reported from Washington.

Rust (Puccinia asparagi): A heavy infection was noted on a small patch of winter onions adjacent to an asparagus bed at University Farm, Minnesota.

Smut (Urocystis cepulae) was said to be severe early in the season in Massachusetts, with injury running as high as 20 percent in non-treated fields. In New York nearly every muck area is now infested but the use of sets and treatment with formaldehyde where infestation is heavy keep the losses reasonably low. They were estimated at from 3 to 7 percent in 1936. Smut was serious in a few fields in Illinois. In Wisconsin the formaldehyde dip is almost universally employed for soil known to be infested. Iowa estimated a 2 percent loss.

Yellow dwarf (virus) was reported from Iowa and California.

APIUM GRAVEOLENS. CELERY:

Early blight (Cercospora apii) was prevalent in the Northeast but was controlled by climatic conditions in the North Central States. Individual State reports are as follows: New Hampshire, "General, much more than usual"; Massachusetts, "Dry weather in late June and during July and a wet September and October rendered the disease less conspicuous than usual on the early crop but more damaging than usual on later settings. Well controlled by good spraying. Loss 8 percent"; Connecticut, usual amount; New York, "Much more prevalent than usual. It was the principal trouble during the year. Loss 2 to 5 percent. Present and destructive on Knob celery, green, and blanching celery in Nassau County. Severe where spinach is sown between celery rows, Richmond County. Most Cercosporae are weak parasites. Apparently this one requires a host weakened by hot weather before infection takes place abundantly"; New Jersey, "Prevalent and severe in some plantings"; Pennsylvania, "General, usual prevalence, loss 2 percent. Dry weather occurred during time injury is usually greatest, and mid-summer was very hot"; Ohio, "Of average severity but not as common as last year"; Michigan, "Much less than in 1935, very low humidity and absence of fogs and dews held disease in check despite very favorable temperatures"; Wisconsin, less than usual. Also reported from California (P.D.R. 21:78).

Fusarium yellows (Fusarium apii and F. apii pallidum). New York, "Gradually spreading in Wayne County and some of the other muck areas. Some fields reduced in yield by half but loss for the State a trace"; Pennsylvania, "Trace of loss locally, not injurious in southeastern Pennsylvania"; Ohio, "Fusarium yellows is becoming increasingly prevalent in Ohio fields and considerable loss has been observed, both this year and last, on some of the late varieties like Pascal"; Michigan, "The general use of Michigan Golden variety is gradually reducing the losses from yellows. Serious in 1936 on susceptible varieties, loss 1 percent"; Wisconsin, usual amount; California, "Much worse in the Sacramento Delta region than in 1935, and much more than usual."

Pink rot (Sclerotinia sclerotiorum) was less prevalent as a storage rot in Massachusetts than last year. The loss was estimated at 5 percent.

In New York each year much of the celery placed in storage is destroyed by this fungus. In 1936, 10 to 20 percent of all celery stored more than two months was lost. Pennsylvania suffered slight loss. In Florida there was more than usual (P.D.R. 20:134-135). In Colorado there was the usual trace of storage decay. The disease occurred in fields in southern California (P.D.R. 21:76, 78).

Late blight (Septoria apii and S. apii graveolentis, mostly reported as the former species) was prevalent and more destructive than usual in some States. It was reported as common in Maine; present in New Hampshire, unusually prevalent in Massachusetts throughout the season, particularly during September and October; perhaps less serious than in average years in Connecticut; not very common this season in upstate New York but very widespread and destructive in Nassau County; severe on some plantings in New Jersey; caused the usual 5 percent reduction in yield in Pennsylvania; was not as common as in 1935 in Ohio; less prevalent than usual in Michigan (both species) because of the very dry hot season, but very destructive in irrigated fields on the late crop; negligible in Wisconsin; not observed in North Dakota; caused an estimated 8 percent reduction in yield in Colorado; and was reported from Washington and California (both species).

Bacterial blight (Bacterium apii) was reported as almost entirely absent in upstate New York where it is usually present.

Virus diseases: Several virus diseases were reported from California. Yellows caused by the aster yellows virus was present in nine counties in central and southern celery-growing sections. As much as 75 percent occurred in fields in Sacramento County. Mosaic and western celery mosaic were reported as prevalent in several counties. The western type was referred to as threatening the industry. Spotted wilt occurred in Contra Costa, Alameda, and San Mateo Counties.

Non-parasitic diseases: Black heart was not as troublesome as in some seasons. It was reported in traces from New York and California. Crack stem was more prevalent in Massachusetts than in 1935 when it was serious in some fields. It usually follows heavy liming. Addition of borax and ammonium sulfate corrected the disease on one farm. The trouble was also reported from Washington.

APIUM GRAVEOLENS RAPACEUM. CELERIAC:

Foot rot (Sclerotinia sclerotiorum) on plants in one field, leaf spot (Septoria apii graveolentis), spotted wilt (virus), and western celery mosaic (virus), were reported from California.

ARTICHOKE, JERUSALEM. See HELIANTHUS TUBEROSUS.

ASPARAGUS OFFICINALIS. ASPARAGUS:

Rust (Puccinia asparagi) attracted considerable attention in a few states because of its appearance in noticeable or injurious amount on Washington strains. In Massachusetts common varieties underwent heavy losses in some sections and even fields reported to be Washington not uncommonly sustained heavy damage. A loss of 4 percent was reported. The disease was not seen in New York this year. In New Jersey it was apparently more severe than in any season since the introduction of resistant varieties. Serious damage occurred this year on both old brush and on seedlings. In some cases the seedlings were completely devoid of green parts before the first frost. A very serious case occurred on a variety supposedly resistant--the Washington variety. (See also P.D.R. 20:301). Maryland observed about the usual amount as did Texas, Wisconsin, and Minnesota. Dr. Leach from Minnesota reported several plantings supposed to be Washington varieties with enough rust to do some harm. North Dakota and Colorado each reported rust but only in traces.

Tip blight (Alternaria sp. and Botrytis cinerea). Davis reported the least seen in ten years in Massachusetts. Stem rot and wilt (Fusarium sp.) was again prevalent in Massachusetts. Young, early sprouts were often destroyed and some growers were unable to store cuttings for any duration. A similar trouble was reported from New York in one instance. Wilt was present in traces in New Jersey. Root rot (Rhizoctonia sp.) was reported as causing 5 percent loss in Texas.

BEAN. See PHASEOLUS VULGARIS.
BEAN, LIMA. See PHASEOLUS LUNATUS MACROCARPUS.
BEET. See BETA VULGARIS.

BETA VULGARIS. BEET, GARDEN:

Scab (Actinomyces scabies) was reported throughout its usual distribution but generally of little importance. It was fairly destructive in only a few fields in Nassau County, New York, though present in many in the trucking areas. Leaf spot (Cercospora beticola) was apparently held in check generally by climatic conditions. Of the ten States reporting its presence only New Jersey found its prevalence up to average. There it was, "Very severe this year, but did not cause serious reduction in yield of beets." Girdle necrosis (Cephalosporium sp.), Washington. Downy mildew (Peronospora schachtii), California. Rust (Uromyces betae), California. Nematode (presumably Heterodera marioni) was reported from one location in West Virginia where it had occurred for several years. Curly top (virus), California, Pacific Northwest (P.D.R. 21:50-54). Mosaic (virus), Washington. See P.D.R. 20:231.

BETA VULGARIS. SUGAR BEET. See BETA VULGARIS under DISEASES OF SPECIAL CROPS.

BETA VULGARIS CICLA. SWISS CHARD:

Leaf spot (Cercospora beticola) was reported severe on some plantings of chard in New Jersey, and from Texas. Downy mildew (Peronospora schachtii), rust (Uromyces betae), the virus diseases curly top and beet mosaic were reported on chard from California.

BETA VULGARIS MACRORHIZA. MANGEL-WURZEL:

Rust (Uromyces betae) was observed in western Washington for the first time.

BRASSICA CAMPESTRIS. RUTABAGA:

Leaf spot (Cercosporella albo-maculans), Massachusetts. Powdery mildew (Erysiphe polygoni), Connecticut. Crown gall (Bacterium tumefaciens) was found in one garden in Tompkins County, New York. It was described as much like club root, except that the swellings were more lobular--resembling slightly a cauliflower head. Mosaic (virus), one report in Connecticut.

BRASSICA OLERACEA ACEPHALA. COLLARDS, KALE:

Downy mildew (Peronospora parasitica) was epiphytotic on collards in seed beds in eastern North Carolina (P.D.R. 20:135).

BRASSICA OLERACEA var. BROCCOLI:
(Probably "Sprouting broccoli" in most cases).

New York and Texas each reported small amounts of leaf spot (Alternaria brassicae). Wire stem (Corticium vagum) caused considerable damage in cold frames in Nassau County, New York. Black leg (Phoma lingam) was reported from New Jersey. New York reported scattered traces of club root (Plasmodiophora brassicae). Practically 100 percent infection with black rot (Bacterium campestre) was observed in one field in New York but injury was slight. The disease occurred less commonly than usual in Wisconsin.

BRASSICA OLERACEA BOTRYTIS. CAULIFLOWER:

Black leaf spot (Alternaria brassicae) was less abundant in Massachusetts than usual, only traces appearing. It is generally less common in upstate New York on cauliflower than on cabbage although a trace was present. It was not uncommon on Long Island as is usual during rainy seasons such as occurred in the fall of this year, particularly on heads carelessly tied or left too long. It was severe locally in New Jersey and occurred in Illinois.

Downy mildew (Peronospora parasitica) was reported from New Hampshire, eastern Massachusetts, and Connecticut. It was present in seed beds on Long Island, New York, but not serious, and not so common on cauliflower as on cabbage, possibly because of greater resistance since cauliflower is usually fed with high-potash fertilizer which should make mildew worse. It was severe in some fields but was not abundant in New Jersey.

Club root (Plasmodiophora brassicae) was surprisingly scarce in Massachusetts even in the old cauliflower-growing localities of Plymouth and Essex counties, a fact attributed to the very dry early part of the season. It was present in New Jersey and the vicinity of Seattle, Washington.

Black rot (Bacterium campestre) was less prevalent on both early and late crops in Massachusetts than usual and caused a loss estimated at 3 percent. In New York an interesting late development of the disease was reported. "None of the disease was present upstate until suddenly in September, after certain rains, a leaf blight which proved to be black rot occurred in many fields over the entire State. Where it was present it infected every leaf in the field. The trouble occurred irrespective of seed treatment, crop rotation, or previous presence of the disease. No such outbreak was ever known to occur in the State before. It came too late, however, to do much damage. Plants were a total loss in a few fields on Long Island. The loss for the State was 3 to 5 percent." (Charles Chupp, H. S. Cunningham, and M. C. Richards). New Jersey and Texas recorded the disease.

Yellows (Fusarium conglutinans) was reported general throughout Nassau County, Long Island, and less prevalent than usual in Wisconsin. Ring spot (Mycosphaerella brassicicola) occurred in King County, Washington, and was abundant in Santa Clara County, California, in February. Peppery leaf spot (Bacterium maculicola): Only scattered traces appeared in Massachusetts in 1936. The trouble was not observed at all in upstate New York. Apparently seed treatments have almost eliminated the organism. Mosaic (virus) was reported as the most common and serious disease of the crop in California. Ring mosaic (virus) was also reported from California on cauliflower. Browning (non-parasitic) was reported from the Catskill district in New York where preliminary experimental work indicated it may be controlled by applications of borax.

BRASSICA OLERACEA CAPITATA. CABBAGE:

Wire stem and damping off (Corticium vagum) occurred chiefly in seed beds in New Hampshire, was rather common in untreated seed beds in New York, especially those under cheese cloth, caused seed-bed injury in Pennsylvania estimated at 0.5 percent, was present in New Jersey, and was found in scattered distribution in Mississippi fields. It caused slight injury in Texas and was present in some beds of seedlings in Kansas.

Yellows (Fusarium conglutinans) is gradually extending its range and rendering cabbage production unprofitable as the soils become infested except through the use of resistant varieties. It was reported from Connecticut, and is gradually spreading in New York State where losses in the infested areas were set at 10 to 20 percent. New Jersey reports restricted areas of serious infestation. It is increasing in prevalence in Pennsylvania and becoming a limiting factor in production. Losses were set at 15 percent. It was more prevalent in Delaware than heretofore; caused a loss of 4 percent in Maryland; and was serious on Norfolk, Durham, and Granville soils in North Carolina. It appeared for the first time in the Charleston section of South Carolina; caused 5 percent loss in Texas and also in Illinois, where in combination with the extreme heat it killed or badly stunted varieties normally resistant. It was more prevalent than usual in Wisconsin and reduced the yield of resistant varieties 7 percent in the Muscatine section in Iowa. In Missouri, where it was general and was more prevalent than usual, the loss was estimated at 5 percent, the most serious damage occurring in home gardens as commercial plantings are usually of resistant varieties. Kansas and California also reported the disease.

Downy mildew (Peronospora parasitica) was sparingly present in Massachusetts and state-wide in New York but occurring principally on the lower leaves. Dr. Chupp states it is more abundant on plots where potash has been applied heavily. It caused little injury in New Jersey. It was epiphytotic in eastern North Carolina and prevalent in many counties of Texas.

Club root (Plasmodiophora brassicae) was reported from its usual range in the northeastern part of the country and in Wisconsin, Minnesota, and Washington. It is perhaps most troublesome in home gardens and in some trucking areas in New York. M. B. Linn writes: "In spite of all control measures club root is still our worst cabbage trouble, but is not serious in Richmond County probably due to rotation."

Black rot (Bacterium campestre). Two states, Maryland and Wisconsin, reported black rot as more prevalent than usual. Other states estimated the usual prevalence or less. In California, M. W. Gardner reported that black rot was observed in Contra Costa County on one plant, apparently for the first time in the State

Black leaf spot (Alternaria brassicae) was nowhere reported as serious and was generally less prevalent in each of the six States reporting its observation. In New York it was reported as injurious to seedlings. Ring spot (Mycosphaerella brassicicola), California. Black leg (Phoma lingam) was nowhere reported as serious. Losses in each of the seven States noting its presence were nominal and generally confined to a trace. Root rot (Phytophthora megasperma), California.

Virus diseases. Virus troubles designated as mosaic were more prevalent than usual in Wisconsin and were reported also from Washington and California. Massachusetts stated that virus yellows was more noticeable than ever before and it was also noted from Washington. Ring mosaic was recorded in California as prevalent.

BRASSICA RAPA. TURNIP:

Black leaf spot (Alternaria brassicae) was abundant on turnips remaining in the field through the winter in North Carolina. Leaf spot (Cercosporella albomaculans): O. C. Boyd, from Massachusetts, reported, "The worst defoliation in certain Cape Cod fields I ever saw--50 percent loss in some fields. Less damage in western Massachusetts. Crop rotation prevents it." Black leg (Phoma lingam) was much worse than usual in some fields on Cape Cod, Massachusetts. It was less noticeable in the western counties. The development was attributed to lack of seed treatment and failure to rotate crops. Leaf spot (Ramularia sp.), Washington. Black rot (Bacterium campestre) was less prevalent than usual in Massachusetts and was reported from New York and Texas.

BROCCOLI. See BRASSICA OLERACEA var.
CABBAGE. See BRASSICA OLERACEA CAPITATA.
CANTALOUPE. See CUCUMIS MELO.

CAPSICUM ANNUUM. PEPPER (including sweet and hot peppers):

Fruit spot and pod rot (Alternaria sp.) developed in Massachusetts; New York, where it followed sun scald causing together losses of 5 to 10 percent; New Jersey, Texas, Illinois, Kansas, and southern California, where pod rot was severe in some fields on pimento and bell peppers.

Early blight (Alternaria solani) occurred on young pepper plants in Georgia (P.D.R. 20:354).

Leaf spot (Cercospora capsici) appeared in occasional fields of pimento peppers in Georgia but is now effectively controlled by most growers by seed treatment. Louisiana reported more than usual on bell peppers with an estimated reduction in yield of 5 percent. Traces were observed in Texas.

Wilt (Fusarium sp.) caused an estimated 10 percent loss in Louisiana. It occurs only on Tabasco peppers but kills the entire plant. Actual counts in three different fields gave respectively 19.7, 22.1, and 65.8 percent of killed plants. In two large fields in southern California it caused the death of 10 percent of the plants, and in red pepper fields amounting to several hundred acres, it attacked 50 percent of the plants, with effects ranging from complete killing to wilting of the plants and drying up of the pods.

Anthracnose reported as Colletotrichum nigrum was found in Louisiana on Bell, Cayenne, and Sport varieties. Anthracnose reported as Gloeosporium piperatum appeared in a few Georgia fields on Pimento peppers but is generally controlled by seed-stock selection and seed treatment. Anthracnose reported as Glomerella cingulata was present in about the usual amount in Louisiana, and as Glomerella piperata was reported in traces from Texas.

Root rot (Phytophthora capsici and Phytophthora sp.). Colorado experienced a 30 percent loss from wilt attributed to P. capsici. California reported a Phytophthora root rot from the region of Merced.

Damping off. Pythium sp. gave trouble in New Jersey. Rhizoctonia solani appeared in occasional seed beds in Connecticut, Georgia, and Texas.

Southern blight (Sclerotium rolfsii) was general in Georgia causing a 10 percent reduction in yield. It was prevalent in Louisiana, principally on Bell peppers but occasionally on other types, and in Texas.

Ripe rot (Vermicularia capsici) caused a loss in grade of 15 percent in Georgia, where it is general. The organism is borne inside the seed coat and disease-free seed stock is needed.

Internal rot (various fungi). According to B. B. Higgins this trouble was less prevalent in Georgia than in 1935 on pimento peppers due to the even distribution of rains during the ripening season. During periods of drought the pistils of blunt-nosed varieties dry and permit the entrance of molds to the interior of the fruits.

Bacterial spot (Bacterium vesicatorium) appeared in traces in Massachusetts, was general throughout southern New Jersey and serious in many fields, and caused very severe injury to young plants in Delaware following late June rains. Higgins estimated a 25 percent reduction in yield of pimento peppers in Georgia. He comments as follows: "Our observations over a period of years indicate that this disease is most destructive when plants have an excess of carbohydrates. This year the early summer was dry allowing plants to become filled with carbohydrates. Periods of rain in July favored spread of the organism. The leaves were lost during July and the first picking was almost totally lost. Only rare fields were free from the disease." The disease was less prevalent than usual in Wisconsin.

Curly top (virus) was important in parts of Texas and in the Pacific Northwest (P.D.R. 21:2, 50-54).

Mosaic (virus). Massachusetts reported the usual amount but less than in 1935, loss, 5 percent. Distribution was general in New York. "The most destructive infection was that occurring early, but the most widespread infection occurred late in August or early September." It was more severe than usual in New Jersey and caused serious losses. "The fruits became yellow and dropped, and V-shaped and necrotic areas appeared on the leaves in the most severe cases. The virus concerned in several badly infected fields was diagnosed as largely tobacco mosaic by F. O. Holmes." Texas, Kansas, and California also reported the disease.

Spotted wilt (virus). New York reported at least six fields of the California Wonder variety seriously affected. This variety is very susceptible. It was found in Suffolk, Ulster, Albany, and Schenectady counties. California reported the disease from six counties with infection varying in different fields from 1 to 90 percent.

Blossom end rot (non-parasitic) was much less prevalent in Georgia. Losses were estimated at only 1 percent whereas usually from 25 to 90 percent of the first picking is ruined by this trouble.

CARROT. See DAUCUS CAROTA.
CAULIFLOWER. See BRASSICA OLERACEA BOTRYTIS.
CELERIAC. See APIUM GRAVEOLENS RAPACEUM.
CELERY. See APIUM GRAVEOLENS.

CICHORIUM ENDIVIA. ENDIVE:

Drop (Sclerotinia sclerotiorum), California. Spotted wilt (virus): California reported the crop ruined at San Pablo, where 70 percent infection was observed. Susceptible varieties were broad leaved or Batavian endive and stag or curled endive. Yellows (virus), New York reported this condition as general in Nassau County with 50 percent infection and 10 percent loss; and in Richmond County with often 50 percent infection and about 30 percent loss. Tip burn (non-parasitic) was present in most fields in Nassau County, New York and caused a total loss in a few fields. It also occurred in Richmond County.

CICHORIUM ENDIVIA. ESCAROLE:

Yellows (possibly virus). New York reported one field in Nassau County 100 percent infected. The trouble was said to be common and causing severe injury in all escarole plantings in the county. New Jersey reported one entire field affected by a disease designated as yellows.

CICHORIUM INTYBUS. WITLOOF:

Spotted wilt (virus) was bad at San Pablo, California on witloof chicory or French dandelion.

CITRULLUS VULGARIS. WATERMELON:

Anthracnose (Colletotrichum lagenarium) appeared in Massachusetts and in Long Island, New York on both leaves and fruit when the vines were not adequately protected. New Jersey, Delaware, and Maryland experienced less than the usual amount of trouble. In southeastern Virginia there was more than in 1935 with a 10 percent loss. It was prominent in North Carolina and especially severe on late plantings. A severe epiphytotic developed in

Mississippi where 75 percent of 3,500 acres observed had from 5 to 100 percent infected melons. The trouble apparently originated in diseased seed. (See P.D.R. 20:255-256). Texas estimated 5 percent, Minnesota and Kansas each reported less than usual. In Minnesota it appeared too late to do much damage.

Stem end rot (Diplodia sp.). Traces were observed in Mississippi and 3 percent loss reported from Texas.

Wilt (Fusarium bulbigenum var. niveum) was severe in many plantings in New Jersey causing death of plants. It was more prevalent than in the previous season in southeastern Virginia where it caused 5 percent loss and where interest in wilt-resistant sorts is increasing; severe, especially on sandy soils throughout North Carolina; generally distributed in Louisiana; and observed in 45 out of 125 fields in Mississippi in amounts varying from a trace to 95 percent. Ten percent prevalence was estimated by Texas, and 25 percent reduction in yield on fields of susceptible varieties was reported by Iowa. Oklahoma and Kansas respectively estimated less and much less than usual and Washington and California reported its presence.

Gummy stem blight (Mycosphaerella citrullina) was found in a few fields in Mississippi late in the season.

Verticillium wilt (V. albo-atrum) was found in California, apparently the first report on the host in this country. (See P.D.R. 20:125-126).

Curly top (virus), Idaho. (P.D.R. 21:54).

Blossom end rot (non-parasitic) caused as high as 95 percent loss in some fields in Mississippi. It appeared most prevalent on the Cuban Queen variety. Texas estimated 6 percent.

Internal browning (non-parasitic) was reported from Georgia and Missouri (P.D.R. 20:257, 292).

CUCUMBER. See CUCUMIS SATIVUS.

CUCUMIS MELO. CANTALOUPE:

Leaf blight (Alternaria cucumerina) was held in check by the dry weather in Massachusetts, Connecticut, New York, Delaware, and Wisconsin. Each of these States reported less than usual. In Maryland it was more prevalent than in an average year. Reduction in yield was estimated at 5 percent with an additional loss in quality of 3. In New Jersey it was very severe in many plantings.

Scab (Cladosporium cucumerinum) was not observed in New York where the hot dry weather was unfavorable to its development. Massachusetts and New Jersey reported its presence.

Anthracnose (Colletotrichum lagenarium) did little damage. Most of the ten States reporting indicated that the disease was less prevalent than usual or restricted to a few scattered localities and none reported serious losses except locally.

Powdery mildew (Erysiphe cichoracearum) was reported from Connecticut, New York, New Jersey, North Carolina, and Texas. It was more prevalent than in an average year in New York but not as much so as a few years ago; and was general in North Carolina where it caused reduction in quality in isolated areas.

Wilt (Fusarium sp., F. bulbigenum var. niveum) appeared in occasional plantings in New Hampshire. It is gradually spreading in New York where four strains of melons from Minnesota proved almost immune. Texas reported 0.5 percent loss. In Minnesota where the loss was 1 percent, it is prevalent locally in Hennepin and Ramsey Counties. It appeared also at Colfax, Washington.

Gummy stem blight (Mycosphaerella citrullina) developed rapidly on petioles, runners, and fruit stalks late in the season in Massachusetts during a period of wet weather. In New York, "Because of the dry hot year there was much more wind-whip, sand-blow, and sunscald injury. Apparently the fungus enters only injured plants. These injuries and the fungus often killed half the plants in a field. Ten to 20 percent loss in the State resulted from the combined injuries." (Charles Chupp).

Downy mildew (Pseudoperonospora cubensis) is never found upstate in New York and was not observed this year on Long Island. It was observed in the usual amount in Maryland with combined loss from reduction in yield and depreciation in quality estimated at 1 percent. In southeastern Virginia it was much more prevalent than in 1935 with reduction in yield set at 10 percent. North Carolina losses were very light. Texas estimated 15 percent. The disease was not seen in Wisconsin. Puerto Rico reported the usual prevalence.

Verticillium wilt (V. albo-atrum) was reported from California. (P.D.R. 20:125).

Bacterial wilt (Bacillus tracheiphilus) appeared in the usual prevalence or less in the northeastern States and Colorado. Because of the dry season it was less prevalent than usual in Oklahoma, and not observed in Kansas at all.

Curly top (virus), Idaho. (P.D.R. 21:53).

Mosaic (virus). Dr. Chupp writes that in New York, "Upstate it has been learned that nearly 90 percent of the inoculum comes from catnip and the wild or bur cucumber. Since both these can easily be eradicated, mosaic has been much reduced. This is not true of Long Island where poke weed is everywhere and almost universally infected." The disease was less prevalent in Maryland than usual, Texas reported a trace, Wisconsin and Minnesota each the usual amount, and Kansas the same as in 1935 but less than in an average year.

CUCUMIS SATIVUS. CUCUMBER:

Leaf blight (Alternaria cucumerina), judging from reports, was generally less prevalent than usual.

Scab (Cladosporium cucumerinum) caused severe spotting of fruits in August and September in Massachusetts. It was much more prevalent locally on Long Island than usual. One six-acre field in particular was badly infected. Other fields in the region were only slightly infected. It was present in New Jersey but not serious except in three fields on the same farm in Atlantic County. "Two of these fields showed a total of ten acres completely destroyed, and others severely injured. The plants had been started in a cold frame and transplanted to the field. This was the most severe case ever observed in New Jersey." In Pennsylvania considerable reduction in grade was reported from one canning plant in Crawford County. Loss for the State was estimated at 2 percent. The dry season practically eliminated scab as a commercial factor in Wisconsin.

Anthracnose (Colletotrichum lagenarium) appeared only in traces in Massachusetts, Pennsylvania, and Wisconsin. It was more prevalent than usual in Maryland where reduction in yield was estimated at 2 percent.

Powdery mildew (Erysiphe cichoracearum) was serious under glass on the spring crop in Massachusetts but was negligible in the open. Reports were received from New Jersey, Virginia, Texas, Washington, and California. Dr. Gardner reported this as the most serious disease of cucumbers along the California coast.

Wilt (Fusarium sp.) was reported in occasional plantings in New Hampshire and from Texas.

Gummy stem blight (Mycosphaerella citrullina) was very prevalent in New York. "Because the hot dry season permitted sunscald, wind-whip, and sand-blow injury, this fungus followed and in many fields as much as 50 percent of the crop was killed. Weather injury plus Mycosphaerella destroyed at least 20 percent of the crop in this State." (Charles Chupp). New Jersey also reported the disease.

Downy mildew (Pseudoperonospora cubensis) was severe in Massachusetts late in the season (P.D.R. 20:286) and was also prevalent in Connecticut where it was too late in starting to do much damage. It was not seen on Long Island this year and is not known to occur in upstate New York. It was observed in the usual amount in New Jersey, was more prevalent in Maryland than in 1935 or in average years, developed to an incidence of 5 percent in Texas, and was not seen at all this season in Wisconsin.

Fruit rot (Phytophthora sp.). W. J. Henderson wrote that this previously unreported disease appeared in a ten-acre field at Rocky Ford in Colorado and entirely destroyed the crop. It is potentially a very serious disease of mature fruits grown for seed purposes.

Bacterial wilt (Bacillus tracheiphilus) was not observed in Massachusetts, but was seen in about the usual amount or slightly more in Connecticut. It was less prevalent than usual in New York, was rather severe in New Jersey, caused 13 percent reduction in yield in Pennsylvania where it entirely destroyed one small field inspected and was present in every planting observed. Maryland estimated the usual prevalence with 1.5 percent loss; Texas, 1. It appeared with average severity in Ohio, was less abundant than usual in Wisconsin, and was noted in greenhouse plantings in San Diego County, California, and in fields in Sacramento and Los Angeles Counties.

Angular leaf spot (Bacterium lachrymans). None was observed in Massachusetts and practically none in New York because of dry hot weather. Pennsylvania reported 2 percent loss, Delaware the usual amount, Wisconsin less, and Texas a trace.

Root knot (Heterodera marioni) was reported from New Jersey where it was most severe in the greenhouse. Carbon bisulfide emulsion 1.36 percent at the rate of 1 gallon per square foot gave commercial but not absolute control.

Curly top (virus), Washington and Idaho (P.D.R. 21:53-54).

Mosaic (virus) was locally destructive in Massachusetts (P.D.R. 20: 287); was more prevalent than usual in Maryland where the combined loss from reduction in yield and in quality was estimated at 6 percent; was severe in occasional fields in New York, but in general appears to be decreasing upstate as a result of increased attention to destruction of weed hosts; was prevalent in southeastern Texas; caused considerable loss in northern Ohio; was destructive in a few plantings but generally speaking of little concern in Illinois; was less prevalent than in average years in Wisconsin; caused the usual trace of loss in North Dakota; was less abundant than in an average season in Kansas; is being brought under control in Colorado through the introduction of the resistant variety Shamrock, which is about 95 percent resistant and is a good slicer type but a poor pickler type; was present in Washington; was relatively scarce in the central California coast districts where Dr. Gardner states it is not a limiting factor as in the East; and was severe in Puerto Rico during the winter of 1935-36 but not in November and December of 1936.

Yellows (virus), Washington.

CUCURBITA MAXIMA. SQUASH:

Powdery mildew (Erysiphe cichoracearum): New Jersey and California reported the presence of mildew, and North Carolina heavy losses of early squash.

Wilt (Fusarium sp.): New Hampshire, Texas, and California reported Fusarium troubles. The California disease was referred to as "root-rot" and the species though not definitely identified was throught to be F. javanicum. The disease was bad on the Zucchini variety at San Pablo and was noted at Laguna Beach and Loma Linda in June.

Gummy stem blight and fruit rot (Mycosphaerella citrullina): Massachusetts reported decidedly less vine infection than in an average season, and somewhat less storage rot than average. One case was reported from New Jersey on the Table Queen variety.

Scab (Cladosporium cucumerinum) was less damaging than usual in Massachusetts. Black mold rot (Rhizopus nigricans): Tucker in Missouri reported that squash harvested when slightly immature and placed in cold storage in Jackson County showed considerable decay. Leaf spot (Septoria cucurbitacearum) Massachusetts, less damage than in most past seasons. Storage rots (various fungi and bacteria) caused a 20 percent loss of the stored crop in Massachusetts.

Bacterial wilt (Bacillus tracheiphilus): New Jersey, common in a few plantings in Middlesex and Monmouth counties. Bacterial spot (Bacterium cucurbitae): Massachusetts, less than in most seasons; New York, very abundant in one planting in Monroe County.

Virus diseases: Curly top was reported from Texas, Washington, and Idaho (P.D.R. 21:2, 52-54); and mosaic from New Jersey, Texas, and California.

CUCURBITA PEPO. PUMPKIN:

Powdery mildew (Erysiphe cichoracearum) was very severe in several plantings in New Jersey but did little real injury, appeared too late in Massachusetts to do much harm, and appeared in the usual prevalence in Connecticut. Curly top (virus) was reported from Washington (P.D.R. 21:52).

CUCURBITA PEPO CONDENSA. SUMMER SQUASH:

Scab (Cladosporium cucumerinum) was more prevalent than in 1935 in Massachusetts where it caused losses estimated at 6 percent. More blossom end rot was observed in upstate New York than usual. A Pythium was isolated. Mosaic (virus) was less prevalent than usual in Massachusetts and was more noticeable in summer than in winter squash.

DAUCUS CAROTA. CARROT:

Scab (*Actinomyces scabies*). Girdle scab was reported from Washington. Pitting and corroding of the roots due to scab occurred in scattered spots in fields in southern California. (P.D.R. 21:77).

Leaf spot (*Cercospora apii-carotae*). The dry summer prevented any serious development of this disease. Massachusetts reported less than usual in that State where it is usually worse in the Connecticut Valley and along the coast. It was rare in New York, appeared locally in Delaware, Texas, northern Ohio, where it was rather severe in some fields, and in California. (P.D.R. 21:77).

Leaf blight (*Macrosporium carotae*) was general but less prevalent than usual in Massachusetts, did little injury in Connecticut, was rare in upstate New York because of the dry weather but present and serious in many fields in Nassau and Richmond Counties, common in New Jersey where in some fields nearly every leaf was brown, less prevalent in Pennsylvania where it appeared only scatteringly, seen only in occasional plantings in Delaware, caused heavy losses in isolated areas on late grown crops in North Carolina, present in Texas to the extent of 1 percent, appeared in mid-September in rather severe form in northern Ohio, was more prevalent than usual in the vicinity of St. Louis, Missouri, where the combined injury to yield and quality was estimated at 7 percent, and occurred along the coast in California where it was serious on fall carrots in the Santa Maria Valley in Santa Barbara County. In Missouri, according to Tucker, the Chantenay variety was somewhat more susceptible than Long Orange, Coreless, or Special Bunching.

Soft rot (*Bacillus carotovorus*): Dr. Davis reported from Massachusetts as follows: "In storage we have seen little of this organism's work on a large scale, but this year a more virulent strain than seen in years caused more storage rot than in the past five years." New Jersey also reported some decay.

Dodder (*Cuscuta* sp.) was reported on carrot from West Virginia and Texas.

Mosaic (virus). California reported mosaic due to the virus of celery mosaic from the vicinity of Los Angeles.

Yellows (virus): Massachusetts reported a 50 percent loss of carrots in a Lexington market garden due to aster yellows virus. Yellows was general in Nassau County, New York, where many fields showed 50 percent infection or 20 percent loss. It seems to become more and more serious each year in Richmond County. Connecticut reported its presence with the comment that it is "recently new to the State apparently".

DIOSCOREA SATIVA. YAM:

The following diseases were reported from Puerto Rico: Wilt (*Fusarium* sp.), which was particularly bad on a white Guinea variety, an undetermined leaf blight, and mosaic (virus) which is prevalent.

EGGPLANT. See SOLANUM MELONGENA.
ENDIVE. See CICHORIUM ENDIVIA.
ESCAROLE. See CICHORIUM ENDIVIA.

HELIANTHUS TUBEROSUS. ARTICHOKE, JERUSALEM:

Rust (*Puccinia helianthi*) was less troublesome than for ten years past in Massachusetts. The dry season held it in check. Stem rot (*Sclerotium rolfsii*) was observed to the extent of 15 and 20 percent respectively in two fields in Mississippi.

HORSERADISH. See RADICULA ARMORACIA.

IPOMOEA BATATAS. SWEETPOTATO:

Soil rot (*Actinomyces* sp.) was prevalent in Atlantic and Cape May counties in New Jersey, caused 3 percent loss in Maryland, and was more serious locally in Louisiana than in former years. Two fields in particular, of eighteen acres and seven acres, were rendered too poor to harvest. The plants were stunted and produced no runners. Apparently the very dry weather was favorable to the disease. Kansas also experienced more than the usual amount of this trouble and Texas reported traces.

Black rot (*Ceratostomella fimbriata*) showed some fluctuations in severity but generally speaking was not conspicuously abundant or scarce. It was reported as follows: New Jersey; Pennsylvania, trace, observed in only one instance; Maryland, 2.5 percent loss in grade and in storage; Louisiana, general, 2; Texas; Oklahoma, general but less prevalent than in 1935; Arkansas, 2 percent reduction in yield; Iowa, more than usual, 3; Kansas, same as in 1935, less than usual, loss 2 percent mainly as a storage rot, also occurred as a hotbed disease.

Rhizoctonia rot (*Corticium vagum*) occurred in Texas and was troublesome on sprouts in hotbeds in Kansas.

Java black rot (*Diplodia tubericola*) was observed in traces in Texas and appeared in Oklahoma with less than the usual slight prevalence.

Stem rot (*Fusarium bulbigenum* var. *batatatis* and *F. oxysporum* f. 2) was reported as follows: Connecticut, one report, new to the State; New Jersey; Pennsylvania, the usual traces of injury locally; Maryland, same as in 1935, more than in average seasons, 2 percent; southeastern Virginia, usual prevalence, 7 percent reduction in yield; Kentucky, "More than usual, hot weather at setting time favored it. Becoming a serious disease in several parts of the State, 15 percent loss" (Valleau); North Carolina, "Worse than has been seen in ten years, heavy losses followed drought conditions in June" (R. F. Poole); Louisiana, general; Texas, traces; Oklahoma; Arkansas, 2; Iowa, "Much more prevalent than usual, 30 percent reduction in yield. Low rainfall and high temperatures caused plants to show symptoms earlier and more markedly. Large losses due in almost every case to failure to hill-select seed potatoes; slip and seed treatment generally practiced among all growers" (S. G. Younkin); Kansas, more than in an average year, same as in 1935, 6 percent; California, "Scarce and of long standing, had difficulty in getting specimens for class use" (Gardner).

Scurf (Monilochaetes infuscans): Five reports were received. Maryland reported more than usual, Virginia less than in average years, and Kansas, none observed. New Jersey and Texas reported its presence.

Foot rot (Plenodomus destruens) was nowhere serious but was observed in Pennsylvania, Maryland, and Oklahoma.

Mottle necrosis (Pythium ultimum) was reported in the usual trace from Maryland. It caused only slight loss in North Carolina.

Sclerotial blight (Sclerotium rolfsii): Texas and Oklahoma each reported injury. The disease was somewhat more prevalent in Oklahoma than usual.

Fasciation (non-parasitic): Connecticut and New Jersey.

Drought injury: Arkansas reported 39 percent loss from drought based on yield figures.

LACTUCA SATIVA. LETTUCE:

Gray mold rot (Botrytis cinerea) in Massachusetts was less prevalent in both early and late plantings than in many seasons. It was present in many fields in Nassau County, New York, and caused 18.8 percent loss in one. It caused severe loss in coldframes in Richmond County when the plants were held too long. The disease is said to be fairly common in cold frames and sometimes may be present to a slight extent in greenhouses or in the field. New Jersey also reported its presence.

Downy mildew (Bremia lactucae): Dr. W. H. Davis stated that he was unable to find the disease in the usual locations in Massachusetts this year. In New York Dr. Chupp states: "Heretofore, downy mildew has been important only in cold frames, but Iceberg is now being grown in some places, and may be completely destroyed by mildew. At Gabriels in Franklin County one farm specializes in Iceberg lettuce and every plant was affected--at least 50 percent loss of the crop." M. C. Richards stated it was present on Iceberg, Romaine, and Boston lettuce and destructive in a few cold frames in Nassau County. In New Jersey it was prevalent under glass in a few cases and appeared occasionally in the field but was not serious. It was reported from three counties in California.

Bottom rot (Corticium vagum) was general in Massachusetts. It was destructive in some seed beds in New York where it is now regarded as of only minor importance because of the general use of dusting for its control. It was the cause of heart decay and blackening of edges of leaves in greenhouses at college farms in New Jersey. It caused heavy losses in beds in the vicinity of Wilmington, North Carolina, was prevalent in Texas to the extent of 3 percent, was noted in gardens in Kansas when the plants were still rather small, and was observed in Washington.

Anthracnose (Marssonina panattoniana) was not observed in New York in 1936 but was reported from Washington.

Drop (Sclerotinia sclerotiorum) was less important in Massachusetts than usual and in New York while always troublesome was probably less so this season than usual. It caused a 20 percent loss in cold frames in a few cases in Nassau County. Texas losses were set at 3 percent.

Drop (Sclerotinia minor) caused some loss of Iceberg lettuce in Richmond County, New York. It was very severe in some fields in August in Passaic County, and in a few plantings under irrigation in Cumberland County, New Jersey.

Stem rot (Bacterium vitians): Dr. Chupp sent the following from New York: "Late in the fall of 1936 lettuce plants were removed from some fields in the muck area and grown in large pots in the greenhouse for the production of seed. The latter part of November, a number of the plants became affected near the base of the stem with a water-soaked slightly discolored rot. The affected plants died. Isolations were made and a bacterium recovered in each case which showed the reactions of Phytomonas vitians."

Virus diseases: Big vein appeared in all fields in Nassau and Richmond Counties, New York, to the extent of 5 percent or less. A low percentage was noted at San Pablo and Concord, California. Mosaic was general in Nassau County, New York, with a prevalence of 10 percent and 1 to 2 percent loss. It was also common in Richmond County causing small losses. New Jersey also reported the disease as present, and it was prominent, but not serious, in the vicinity of Wilmington, North Carolina. Spotted wilt is increasing in California. All varieties appear susceptible. This year one grower reported 200 acres lost in the Gonzales region, and scattered infections appeared around Salinas. It is a limiting factor at San Pablo. Yellows: Aster yellows was reported as serious at Lexington, Massachusetts (P.D.R. 20:302), and general in Nassau and Richmond Counties, New York, where 50 to 60 percent infection developed in fall and summer crops. It was also reported from Texas.

LETTUCE. See LACTUCA SATIVA.

LYCOPERSICUM ESCULENTUM. TOMATO:

Fruit rot (Alternaria fasciculata). This organisam followed blossom-end rot in one field in Georgia. (P.D.R. 20:353).

Collar rot and early blight (Alternaria solani). Early blight occurred in New Hampshire. It was general but less prevalent than usual in Massachusetts where it is well controlled in staked and trellised fields by dusting or spraying. Losses, only on untreated fields, were estimated at 7 percent for the State. It was rather more prevalent in Connecticut than in 1935 but did not do serious injury. In New York because of the dry hot weather there was almost no leaf blight in the fields but severe injury occurred in cold frames early in the season on some farms. New Jersey reported collar rot as severe in many fields. One lot of many thousands of plants from one seed source had to be discarded because of severe infection in cold frames. Pennsylvania estimated the usual amount of leaf blight and collar rot with losses set at 8 percent. Maryland had more leaf blight than usual but less than in 1935 and less collar rot than usual. Losses were estimated at 5 and 0.2 percent respectively. The fungus was abundant throughout North Carolina. The situation in the important tomato plant producing sections of Georgia is reported by J. H. Miller (P.D.R. 20:351-352). It appeared in 50 out of 80 fields examined in Mississippi in amounts varying from 1 to 100 percent of the plants infected. It was general and prevalent in the usual amount on leaves and fruit in Louisiana. Texas reported 5 percent of a "new collar rot" attributed to Alternaria sp. and 1 percent early blight due to A. solani. Arkansas reported traces. It was "fairly common" in Ohio. Collar rot was more prevalent in Indiana than usual and much more so than in 1935, probably because of favorable warm wet weather during the plant bed season in the southern region producing plants, according to R. W. Samson. The early blight also was more prevalent owing to favorable weather and abundant inoculum. Collar rot was noted in Illinois on tomatoes from the South. Early blight was unimportant in Michigan and collar rot was not observed. Wisconsin reported less than usual, Colorado somewhat more, and California heavy infection at Colma in November.

Nail head spot (Alternaria tomato): Georgia (P.D.R. 20:354).

Leaf mold (Cladosporium fulvum) was serious as usual under glass in Massachusetts, appearing in discouraging proportions on the spring crop in early April and again on the fall crop in October. It was also somewhat more prevalent than in 1935 in Connecticut and was particularly bad in one greenhouse. It was not observed on outdoor grown plants in New York, but was serious in a few greenhouses. One report was received in New Jersey on field grown stock. Pennsylvania, Louisiana, and Texas reported the usual prevalence. Oklahoma had less than usual. It persisted in several Ohio fields which were planted in proximity to greenhouses in which the disease was present in the spring. It was serious only in greenhouses in Wisconsin and California.

Anthracnose (Colletotrichum phomoides) was general in Maryland but caused only slight loss. It was present and destructive in Nassau County, New York, appeared in traces in Texas, and only to a very slight degree in Kansas where the weather was too hot to permit setting of fruits.

Fusarium wilt (Fusarium bulbigenum lycopersici) is less important commercially than formerly due to the general use of resistant varieties as may be seen from the following reports from nineteen States. New Hampshire, on greenhouse tomatoes; Massachusetts, only in an occasional garden or field; New Jersey, one planting in Cumberland County showed 5 percent infection; Pennsylvania, more than usual, one four-acre field a total loss due to this disease; Maryland, usual amount of scattered distribution, 1 percent; southeastern Virginia, locally present causing 10 percent loss; Kentucky, "Tomatoes for canning crop are nearly all wilt-resistant, consequently it is not a factor any longer"; Georgia, "Some wilt found in almost every field inspected; in one field the organism followed blossom-end rot on the fruit" (P.D.R. 20:353); Mississippi, generally observed in all localities, loss 1 percent; Louisiana; Texas, 5; Oklahoma, less than formerly; Arkansas, trace; Michigan, trace, "Slight economic importance in field tomatoes. Occasionally severe in forcing houses. Observed in plantings from seedlings grown in Georgia"; Wisconsin; Iowa, trace; Missouri, "More than usual, 10 percent loss. Warm dry season caused early wilting. Most wilt in home gardens. Commercial plantings usually of resistant varieties"; Kansas, 1 percent; Colorado, trace; California, "Not a serious factor in the canning crop of central California. Serious in the early staked crop at Merced and in hot valleys of southern California, and less in the Central Coastal region."

Fruit rot (Fusarium solani) followed blossom-end rot on a few fruits in one field in Georgia (P.D.R. 20:353).

Fruit rot (Oospora lactis parasitica) was reported for the first time from Missouri where it was observed causing considerable damage in greenhouses in Jackson County.

Pipe rot (Phoma destructiva) followed sunscald in the autumn in New York, was found in only one field in Georgia, and was present to the extent of 1 percent in Texas.

Late blight (Phytophthora infestans) was much less damaging in fall field crops in Plymouth and Bristol Counties, Massachusetts, than in the past few years. It appeared scatteringly in eastern Middlesex County in both field and greenhouse crops. Dr. Clinton wrote from Connecticut as follows: "Two reports and then only on fruit. No damage this year. Our investigations show only that this blight passes from infected potato fields to the nearby tomatoes for the first infection of the latter"; New York, none was observed or reported this season except that it was found on plants shipped into Nassau County from North Carolina. Traces appeared in Pennsylvania, and it was observed in one field in Mississippi and to a slight extent in Texas. It was general in Los Angeles County, California, and is a limiting factor in late fall shipping crops in the southern coastal districts.

Buckeye rot (Phytophthora parasitica) caused a trace of loss in Maryland where it was less prevalent than in 1935. It occurred on staked tomatoes as well as on those on the ground in northern Ohio where it was rather severe in some fields. In Missouri it caused some rotting of stems and roots of plants 8 to 12 inches high in greenhouses in Boone and Jasper Counties. It was severe in Puerto Rico near Ponce.

Pleospora rot (Pleospora lycopersici) was not observed in California this year.

Damping off and rot (Rhizoctonia solani and Rhizoctonia sp.). R. solani caused severe losses in cold frames in Nassau County, New York, and was the cause of 2 percent crown or foot rot in Texas as well as traces of soil rot. Damping off due to Rhizoctonia sp. was observed in several instances in New Jersey.

Rhizopus canker (Rhizopus sp.). Dr. Gardner reported from California a "conspicuous yellowing of one shoot cut off at the base by Rhizopus entering through an early fruit that had rotted". This type of disease was first observed in Fresno County in 1934.

Stem rot (Sclerotium rolfsii) was found generally in all sandy fields observed in Mississippi. It was prevalent in Texas. R. W. Samson reported from Indiana that it was frequently found on Georgia-grown plants, and developed extensively in many lots of heeled-in plants. The situation in the Georgia seedling plant regions is reported by J. H. Miller (P.D.R. 20:352).

Leaf spot (Septoria lycopersici) was general and very prevalent in Massachusetts where it caused decidedly more damage in some fields than did early blight. It was prevalent in Connecticut but mostly caused only minor injury complicated with early blight. New York as a whole suffered only a trace of loss. The disease was general but not serious, however, in Nassau County. Severe infection developed in one field where seed came from middle states, and one serious outbreak originating in southern grown seed was noted in a greenhouse. The disease was recorded in New Jersey; less prevalent than usual in Pennsylvania; more abundant in Delaware, and very severe on late plantings; scattered and less common than in an average year in Maryland; Kentucky; was much less than usual in Georgia this year, where it appears only on the late crop; generally observed but neither abundant or destructive in Mississippi; rather generally distributed in Texas; and present only in traces in Arkansas. Leaf spot was fairly common in Ohio; of minor importance in Illinois. It caused much defoliation in Wisconsin after late rains in September greatly reducing the quality of the canning crop. Iowa reported 1 percent; Kansas, much less than in average years; and Colorado a trace.

Gray leaf spot (Stemphylium solani), Georgia (P.D.R. 20:355).

Verticillium wilt (Verticillium albo-atrum). Several severe cases with one field a total failure were observed in Massachusetts. There was more in Pennsylvania than usual but losses for the State did not exceed a trace. It was found at Santa Maria, California, by Dr. Newhall and the organism identified by Dr. Rudolph.

Bacterial canker (Aplanobacter michiganense) was recorded from Massachusetts; one occurrence was reported from Connecticut; and one from Albany County, New York, in which about half the crop was destroyed. Very few cases developed in New Jersey, and in Pennsylvania with 1 percent reduction in yield care in selecting seed sources and in seed treating and planting has kept the disease down. Delaware reported general prevalence in the State for the first time with losses running up to 75 percent in some fields. Maryland had the usual amount with losses estimated at 0.5 percent, and eastern Virginia much more than usual--apparently brought in on Georgia stock. (See P.D.R. 20:226, 289-290). It was not found in any seedling plant field in Georgia, but it rarely shows until the plants are almost mature (P.D.R. 20:352). It was found in many fields in Mississippi varying from a trace to 10 percent of infected plants. Texas reported 3 percent. In Ohio, where this disease is said to be unusual, it occurred in several fields this year and in most cases could be traced back to certain lots of seed. It was a serious disease in one planting in Illinois and of minor concern in a few others. Michigan had much less than in 1934 and 1935. The use of certified seed and rotation contributed to the decrease and the dry season was very unfavorable for fruit infection. Wisconsin and Minnesota reported more than usual and Kansas none. Colorado with increased prevalence estimated 7 percent loss. In California it was general, and serious as usual in Sacramento, Stockton, Concord, Dublin, and Old Gilroy areas.

Bacterial speck (Bacterium punctulans). Mississippi.

Bacterial wilt (Bacterium solanacearum) was severe in a few plantings in New Jersey but in general not serious. It was observed in several fields of Georgia-grown plants in Maryland, was severe in ten counties in northeastern North Carolina, and present with an average prevalence of 5 percent in 15 Mississippi fields examined. Texas reported 2 percent. In Georgia plant-growing regions it did not occur until after the shipping season (P.D.R. 20:352, 353).

Bacterial spot (Bacterium vesicatorium) was more than ordinarily prevalent in Maryland. There was very little in Georgia. It appeared in Mississippi and Texas to a noticeable extent. Slight infection developed in 3 Michigan plantings grown for seed but the disease was not of commercial importance.

Root knot (Heterodera marioni) was troublesome as usual particularly in greenhouses and in many southern fields. Nine States submitted reports in line with previous records.

Bunchy growth (virus?): "In one field in Chautauqua County, New York, about 1 percent of the plants had peculiar bunched tops. Some of the earliest affected plants were much dwarfed, while some of the large plants had their tops in very dense masses, which were almost as large as bushel baskets. The source of these plants could not be discovered." Charles Chupp.

Curly top (western yellow blight, due to virus) was apparently less serious than for the two preceding years. Colorado estimated 3 percent loss. Both Utah and Washington reported the trouble as serious in sections but not as prevalent as in 1934 and 1935, and California stated that prevalence was lower in the fields observed. Occurrence in Texas, Idaho, Oregon, and Washington is reported in the Reporter (P.D.R. 21:2, 50-54).

Mosaic (virus) was more prevalent than last season in Massachusetts and in Connecticut due to aphid abundance. New York suffered only slight loss and stated that the disease is gradually being overcome by care in seedling growing. New Jersey reported yellow mosaic prevalent and in some cases causing serious losses with partial recovery in others. Pennsylvania, Delaware, and Maryland, more than usual. It was almost completely absent in Mississippi and sparingly present in Louisiana, Texas, and Oklahoma. Michigan had less than usual, "probably due to the scarcity of the aphids because of the dry season". Wisconsin reported the usual amount; Iowa, 2 percent; Kansas, less than usual of both cucumber and tobacco No. 1 viruses; Colorado, heavy losses in greenhouses in several localities, 7 percent loss for the State. California reported the type caused by tobacco virus No. 1 statewide with the crop. Its worst effect is the calico pattern on the fruit. The fern-leaf mosaic due to cucumber mosaic virus was also widespread but with a low percentage in each field.

Spotted wilt (virus) was present in New York in Albany, Suffolk, and Ulster counties. It was observed in Texas, and in Michigan it occurred in one greenhouse planting and in trial grounds. An outbreak was reported from Utah (P.D.R. 20:143-144). About a third of the plants in a greenhouse near Seattle, Washington, were affected (P.D.R. 20:332). The disease is becoming a limiting factor in most coastal districts of California. "It seems to spread from endemic centers characterized by frost-free winters and abundant winter host plants. Over 100 host species." M. W. Gardner.

Streak (virus) was very serious in one greenhouse in New York, but the trouble is gradually being eliminated by care in growing plants. In New Jersey only a few affected plants were seen. One Pennsylvania greenhouse showed at least 4 percent loss but the trouble was difficult to find elsewhere. Wisconsin and Washington recorded the presence of the disease.

Blossom end rot (non-parasitic) was very prevalent in many States. State reports with comments follow: Massachusetts, much less than usual; New York, very serious in some fields especially in Chautauqua and lower Erie Counties, only traces in Nassau County; New Jersey, some of the fields had to be plowed out during the drought period because of the severity of the disease in south Jersey; Pennsylvania, more abundant than usual, 10 percent reduction in yield plus 2 percent loss in quality; Maryland, much more, dry during early harvest; Kentucky, much blossom-end rot on all but late crop; North Carolina, severe following the drought of June; Georgia, at least half of early crop lost, but the rot stopped with the rains and cloudy weather in the middle of August (P.D.R. 20:353); Mississippi, much more, loss in field ranged from 5 to 90 percent with an average of 25; Texas, 5; Arkansas, 2; Ohio, fairly common; Michigan, more, the very dry season followed by heavy rain in September brought on a serious development of blossom-end rot; Wisconsin and Minnesota, each the usual amount; Iowa, more, 8 percent; North Dakota, more, general; Colorado, usual trace; Washington.

Boron (?) injury. Injury not further described thought to be due to excess boron or alkali, occurred in Contra Costa and Santa Clara Counties, California.

Cat face and growth cracks (non-parasitic). Mississippi (P.D.R. 20:224).

Drought injury. Dry hot weather was reported as the cause of heavy loss in several regions. In New York, Dr. Chupp reports: "In Chautauqua and lower Erie Counties, the drouth started so early that in many fields half the plants died before beginning to bear fruit. A survey was made with a representative of the American Can Company. Instead of the usual average of 8 tons for canning tomatoes, the canners estimated a yield of no more than 4.5 tons. Rains and delay of fall frosts helped the crop, however, so that the average yield was more, nearly 5.5 tons an acre. The injury was the dying of all the older lower leaves and the lack of fruit set. It in no way resembled a fungus or bacterial disease." In Kentucky early tomatoes set poorly because of heat and drought. In Arkansas a loss of 75 percent due to drought was based on yield figures.

Lightning injury. In New Jersey a few cases were observed where plants in a circular area, three feet in diameter, died suddenly after a thunderstorm. In Delaware in one case plants in a 20-foot diameter circular area were killed outright. Macrosporium and Phoma followed as secondary growth on the killed stem tissues.

Sun scald (non-parasitic) was reported as follows: Connecticut, on fruit; New York, "Always a serious problem late in the summer"; New Jersey, general in south Jersey; Delaware, very general throughout the State during the week of July 12; Maryland, general; Mississippi, observed in all fields inspected.

Cloudy spot (cause unknown). Mississippi (P.D.R. 20:224).
Leaf roll (cause unknown). Georgia (P.D.R. 20:355).

MUSKMELON. See CUCUMIS MELO.
ONION. See ALLIUM CEPA.
PARSNIP. See PASTINACA SATIVA.

PASTINACA SATIVA. PARSNIP:

Leaf spot (Cylindrosporium sp.), Washington. Leaf spot (Ramularia pastinacae) was less prevalent than in average years in Massachusetts because of the dry season. It appeared scatteringly in traces throughout New York State.

PEA. See PISUM SATIVUM.
PEANUT. See ARACHIS HYPOGEA UNDER DISEASES OF SPECIAL CROPS.
PEPPER. See CAPSICUM ANNUUM.

PHASEOLUS LUNATUS MACROCARPUS. LIMA BEAN:

Leaf spot (Cercospora cruenta) caused severe injury to leaves and probably reduced the yield in the trucking sections of eastern Virginia. Pod blight (Diaporthe phaseolorum) was observed in several New Jersey plantings, appeared less prevalent in Maryland than in 1935, and was seen only in one instance in Pennsylvania. Scab (Elsinoe phaseoli) was common but not abundant in Puerto Rico. Root rot (Fusarium spp. and other fungi) caused the usual injury in Maryland. Losses were estimated 1.5 percent. Downy mildew (Phytophthora phaseoli) was not observed in New York this season, was of little economic importance in New Jersey, caused the usual trace of loss in Pennsylvania, and was only scatteringly present in Maryland with less prevalence than in 1935.

Bacterial diseases. A bacterial blight was general in eastern Virginia where it was estimated to have caused 5 percent reduction in yield and an additional loss in quality of 5 percent. One field attacked by Bacterium phaseoli was observed in Los Angeles County, California. Traces of Bacterium vignae were reported from New York and Maryland but no appreciable injury.

Virus diseases: Curly top was reported from Idaho (P.D.R. 21:53); mosaic from New York (P.D.R. 20:291).

PHASEOLUS VULGARIS. BEAN:

Anthracnose (Colletotrichum lindemuthianum) is no longer a serious factor in bean production because of the general use of clean seed produced in the West. This year climatic conditions placed a further check on the development of anthracnose. Of the fifteen States reporting only Delaware noted prevalence greater than in 1935 or in average years. It was general in home plantings there and severe in late fall plantings. Massachusetts reported the usual scattered distribution and 0.5 percent loss. No trace was found in New York although a large number of fields were examined. This was true of Arkansas and Michigan also. Other States reported less than usual or scattered traces.

Rhizoctonia stem canker (Corticium vagum) was generally observed in small amounts in all fields examined in Mississippi. It was general but less prevalent than usual in Louisiana, appeared in Texas to the extent of 5 percent, and only in traces in Michigan.

Powdery mildew (Erysiphe polygoni) was reported as follows: New York, "In early September, powdery mildew suddenly became common over a wide area of the State. It attacked both snap and dry beans, but probably came too late to cause much actual loss."; Pennsylvania, more prevalent than usual but caused only a trace of loss; Maryland, more prevalent than usual due to the "large acreage of the fall crop", loss 0.1 percent; eastern Virginia, general, "occurs only on fall snap bean crop", reduction in yield 5 percent plus a similar additional loss in quality; North Carolina, "Abundant, especially in the eastern part of the State"; Texas, 1 percent; California.

Dry root rot (Fusarium solani var. martii f. 3 and Fusarium spp.) was recorded from Massachusetts, "More prevalent than in average years, generally more noticeable in home gardens than in commercial plantings, most destructive in seedling stage, loss 6 percent"; New York, 1 or 2 percent. "Since more resistant types are being grown, longer rotations practiced, and yellow eye varieties grown farther away from the center of infection, dry root rot is gradually becoming unimportant"; Pennsylvania, general, 5 percent reduction in yield; Maryland, less than in 1935, 2.5 percent loss; Michigan, trace; Iowa, trace; Wyoming, 4 percent; Colorado, trace.

Wilt (Fusarium sp.), New Hampshire.

Angular leaf spot (Isariopsis griseola): New York, "Collected only once--rare. Recently I had occasion to examine all the specimens in the Cornell herbarium and found that all of these were Cercospora columnare." (Chupp).

Leaf spot (Phyllosticta sp.), Washington.

Charcoal rot (Rhizoctonia bataticola) was reported from California in Tehama and Ventura Counties.

Pod rot (Sclerotinia sclerotiorum) because of the dry season was much less prevalent in Massachusetts than for ten years. It also occurred in Washington.

Southern wilt (Sclerotium rolfsii) was troublesome in Mississippi, Louisiana, and Texas.

Rust (Uromyces phaseoli typica) was unusually prevalent in several regions as may be seen from the reports abstracted as follows: Massachusetts, "About normal on pole beans, but worst I have ever seen it on bush bean green leaves. Caused noticeable damage even on bush beans of the French Horticultural varieties. Mostly confined to the eastern part of the State", (O. C. Boyd); Connecticut, more prevalent than in 1935; New York, "In late September and early October, rust suddenly became more common than usual, little damage except in a few late snap beans." New Jersey, "Rust is unusually prevalent this fall. Our past records going back to 1913 show only traces or occasional infested fields annually but this fall the disease is of Statewide distribution and the cause of serious defoliation in many fields." (C. M. Haenseler); Pennsylvania, much more, "One field of 200 acres showed 100 percent infection although loss was low due to late occurrence." (O. D. Burke); eastern Virginia, "Much more, 10 percent reduction in yield, spraying and dusting with sulphur failed to control", (Harold T. Cook); North Carolina, "Severe especially on pole beans in many parts of the State"; Florida, developed in epiphytotic proportions; Mississippi, found on leaves only in a few fields; Louisiana, less prevalent than in average years; Texas; Arkansas, "not seen"; Wisconsin, "no reports"; Colorado, trace; Washington, "Serious in Whatcom County this year, usually causes little injury" (Glenn A. Huber); California. (See also P.D.R. 20:133, 173, 192, 235, 282, 285, 292, 303, 327, 352.)

Bacterial wilt (Bacterium flaccumfaciens) was more prevalent than usual in Michigan. It was severe in a few early planted fields but less damaging in late plantings.

Bacterial blights (Bacterium phaseoli and B. medicaginis phaseolicola). One or both of the bacterial blights were reported from twenty States. Losses when estimated generally varied from a trace to 2 percent but Colorado estimated 20 percent reduction in yield with prevalence of B. phaseoli much greater than usual, Michigan 2.5 and 5 percent losses respectively from B. phaseoli and B. medicaginis phaseolicola, and Wyoming 1.5 and 3.5 percent as the total losses from the respective diseases. Maryland, Ohio, Wisconsin, and Kansas experienced less than the usual prevalence, and Louisiana and North Dakota more.

Curly top (virus): Idaho estimated 10 percent loss from curly top with incidence less than in 1935 or in average years. W. H. Pierce reports that the varieties Red Mexican and Burtner's Blight Proof are immune from curly top, Great Northern U. I. No. 81 and No. 123 resistant, snap bean varieties in general are susceptible, and Red Kidney and Bountiful very susceptible. Snap beans were severely damaged in the Bend-Redmond area of eastern Oregon according to B. F. Dana (P.D.R. 21:51).

Mosaic (virus): Reports were received from nineteen States and from Puerto Rico where mosaic is common and abundant. Losses in general were not serious as resistant varieties are being brought into general use. New York and Idaho reported prevalence lower than in 1935, and Pennsylvania, Maryland, and North Dakota, higher. Clover mosaic occurred on Red Kidney beans in western New York. Yellow mosaic was observed in New York in fields of Wisconsin Refugee which is immune from the common bean mosaic. Another disease, apparently due to a virus, causing malformation, mosaic marking of the leaves, necrosis of the veins and petiole, and sometimes malformation and necrosis of the pods was also observed on the same variety. (P.D.R. 20:290-291).

PISUM SATIVUM. PEA:

Root rot (Aphanomyces euteiches) appeared in Massachusetts especially in lower, damper portions of fields, caused 15 percent reduction in yield in Pennsylvania; was prevalent but of little economic importance in New Jersey; developed early and in greater prevalence than usual in Maryland causing about 5 percent loss; was common on early peas in eastern North Carolina; and developed in about the usual severity in Wisconsin.

Ascochyta blights: Ascochyta spp. appeared scatteringly in New York and Maryland in association with Mycosphaerella pinodes but caused little damage. Foot rot (Ascochyta pinodella) was more prevalent than usual in California and was a factor in the blight epiphytotic there, but was overshadowed by Mycosphaerella. Leaf and pod spot (A. pisi) caused the usual trace of loss in Pennsylvania, was noted in home gardens in Arkansas, and appeared in less than the usual prevalence in Michigan because of the dry season. It caused a 5 percent reduction in yield in Colorado and was more prevalent than usual in the coastal counties of California. (See also Mycosphaerella).

Botrytis blight (Botrytis sp.) was recorded from three counties in western Washington.

Scab (Cladosporium pisicola) was found in Maine for the first time; developed abundantly in most pea plantings in western Washington where it seems to be one of the more important problems; and was reported from California where it occurred on early spring peas but was most common and caused considerable trouble on late fall plantings. It was not so prevalent at the height of the growing season.

Root rot (Corticium vagum) was reported from Massachusetts, New Jersey, Mississippi, Texas, Michigan, and Washington, but caused little damage. Seed treatment with black oxide of copper resulted in increased stands in Michigan.

Powdery mildew (Erysiphe polygoni) was reported from seven States but it was of little importance generally. It was more serious than usual on the spring crop in the Sacramento Valley in California because of weather conditions favorable to the disease.

Fusarium wilt (Fusarium orthoceras var. pisi) appeared only in scattered traces in New York where it is rare. It was reported from Pennsylvania together with root rot. It was less prevalent than usual in Maryland where more than 50 percent of the canning crop is now planted with either Maryland Alaska, H F-30, or Asgro Alaska Strain No. 5, three resistant varieties developed at the Maryland Experiment Station. Wisconsin also reported diminishing losses because of increased use of resistant strains. Traces occurred locally in Wyoming. Losses in Idaho seed producing areas were low due to planting resistant varieties such as wilt-resistant Alaska or Perfection. The disease is present in most areas in western Washington where peas are grown. Wilt was more prevalent than usual in San Luis Obispo County, the only region where it is known to occur in California. The size of the spots in infested fields continues to increase.

Near wilt (Fusarium oxysporum f. 8) occurred in about the usual amount in Wisconsin, Idaho, and Washington. In California it occurs only in San Luis Obispo County and the infested areas are increasing in size from year to year, as with wilt.

Root rot (Fusarium solani var. martii f. 2) was less prevalent in Massachusetts than in 1935. It was noted in small amounts in Pennsylvania throughout the State, developed locally in the usual prevalence in Wisconsin, was estimated to have caused reduction in yield locally of 20 percent in Colorado and about 10 percent in Idaho where distribution is general. It was reported from King County, Washington, and occurred as usual on summer peas grown in the interior of California where subject to high soil temperature.

Mycosphaerella blight (Mycosphaerella pinodes) appeared only in scattered traces in New York where the use of clean seed and crop rotation have reduced the disease so that it is no longer important; was less prevalent in Maryland, causing an estimated loss of 0.3 percent (with Ascochyta spp.); developed only in traces in Texas, and in less than the usual prevalence in Wisconsin. Washington recorded it as present in King and Pierce Counties. It was much more prevalent in the coast regions of California than in an average year and more prevalent than in 1935. Inoculum in the form of infected pea straw was plentiful resulting in heavy ascospore discharges early in January, and abundant rains during the growing season fostered the development of the disease.

Downy mildew (Peronospora viciae) was often observed in New York fields but never seemed to cause damage. It was less prevalent than usual in Wisconsin due to dry weather; was abundant on foliage in western Washington (reported as P. pisi) and damaged pods in several counties. Only slight infection was seen in California.

Root rot (Pythium spp.) was serious on the canning crop in New York causing losses of from 5 to 10 percent.

Blotch (Septoria pisi) was less prevalent than in most seasons in Wisconsin.

Rust (Uromyces fabae) was observed in Texas and Washington.

Bacterial blight (Bacterium pisi) was reported from New Jersey, Maryland, Michigan, Wisconsin, Wyoming, and Colorado. Losses were negligible.

Mosaic (virus) was much less prevalent than in 1935 in New York, due in part at least to the less general planting of highly susceptible Alderman and Telephone types. (See P.D.R. 20:259-260). Texas estimated 1 percent. In Idaho only negligible losses resulted on seed peas, due to the use of resistant varieties. The usual amount occurred on green pod shipping peas since resistant varieties are not suitable for this purpose. Both mosaic and a form designated severe mosaic were important in Washington. (See P.D.R. 20:233).

Internal necrosis (virus?). This trouble, suspected to be a symptom of a virus infection, was observed in Island County, western Washington.

Boron injury (boron in irrigation water). One field near Hollister, California, was severely injured by boron in irrigation water, as diagnosed by County Agent McCallum. (C. E. Scott).

Weather injury: Drought caused 50 to 95 percent loss in Massachusetts, severe injury in Arkansas, and was reported from Washington. High temperature and aphids accounted for a 25 percent loss in Wisconsin, and late frosts in upstate New York took 10 to 20 percent of the canning crop.

POTATO. See SOLANUM TUBEROSUM.
PUMPKIN. See CUCURBITA PEPO.

RADICULA ARMORACIA. HORSERADISH:

White rust (*Albugo candida*) was less prevalent than in 1935 but still general throughout Nassau County, New York. It occurred in New Jersey and made its appearance late in the season in Illinois causing slight leaf injury. Leaf spot (*Cercospora armoraciae*), although less prevalent than in average years in Iowa, was estimated to have caused a loss of 8 percent. Leaf blight (*Macrosporium* sp.) was very severe in one commercial planting at Newcastle, Delaware, following a storm in September. Leaf spot (*Ramularia armoraciae*) appeared scatteringly in traces throughout New York State.

Root rot (*Bacterium* sp.): Forty-five percent infection was observed in one field in Nassau County, New York.

Brittle root (undetermined), a disease strongly resembling curly top as described on horseradish from western areas, has occurred in Illinois for several years but usually causes only slight losses. In 1936, however, it was epiphytotic. The beet leafhopper, previously not reported from Illinois, was collected from affected plants (P.D.R. 20:288; 21:102).

RADISH. See RAPHANUS SATIVUS.

RAPHANUS SATIVUS. RADISH:

White rust (*Albugo candida*) was a serious disease in some greenhouses in New York. It was less abundant than usual in Wisconsin. Black root, reported as due to *Aphanomyces raphani*, occurred in Connecticut, as *Pythium aphanidermatum* was less prevalent than usual in Wisconsin because of the dry season. Damping off (*Pythium* sp. and *Rhizoctonia* sp.) did very little damage in Massachusetts because of the dry season. Black root or purple root (cause undetermined) was general in parts of Nassau County, New York, and caused a total loss in many beds. Root rot (*Corticium vagum*) caused 10 percent loss in greenhouses in Jackson County, Missouri. Downy mildew (*Peronospora parasitica*) was general in Nassau County, New York, and did severe damage in a few fields.

Mosaic (virus) was observed on Chinese radish at Palo Alto, California.

Weather injury (drought) caused much difficulty with seedlings in Massachusetts with loss estimated at 50 percent.

RHEUM RHAPONTICUM. RHUBARB:

Root rot (*Armillaria mellea*) was present in several spots in one field in Los Angeles County, California. Leaf spot (*Ascochyta rhei*), Connecticut and New Jersey. Crown rot (*Corticium vagum*) was estimated at 3 percent prevalence in Texas. Leaf spot (*Phyllosticta straminella*) was general in New York. Crown rot (*Phytophthora cactorum*) occurred in Pennsylvania in about the usual prevalence. Mosaic (virus), Washington. Ring spot (virus) was observed at San Pablo, California.

RHUBARB. See RHEUM RHAPONTICUM.
RUTABAGA. See BRASSICA CAMPESTRIS.
SALSIFY. See TRAPOGON PORRIFOLIUS.

SOLANUM MELONGENA. EGGPLANT:

Verticillium wilt (Verticillium albo-atrum) appeared in the usual prevalence in Massachusetts where losses were set at 20 percent. It was present in Connecticut and caused losses of 10 to 20 percent in New York where it was state wide. M. C. Richards reports that he even found one affected plant in a roof garden in Radio City. It was generally prevalent as usual in New Jersey, was reported from Ohio and Illinois. California reported it from Marin County and also on the seed crop in Orange County.

Fruit rot (Alternaria solani), New Jersey and Massachusetts. Gray mold (Botrytis cinerea) New Jersey, little damage. Fruit rot (Phomopsis vexans) appeared in traces in Massachusetts, was severe in plantings throughout New Jersey and caused 5 percent loss in Texas. Southern blight (Sclerotium rolfsii) caused losses in eastern Virginia and Texas set at 1 percent. A 32 percent infection was noted in one Virginia field. New York reported dry hot weather resulting in much sunscald of the fruit followed by Macrosporium sp. and Colletotrichum sp.

Bacterial wilt (Bacterium solanacearum) was observed in New Jersey in only one field where plants were ditch irrigated with water from a sewage disposal plant.

Mosaic (virus) was prevalent late in September in Massachusetts and present to the extent of 2 percent in Texas.

SOLANUM TUBEROSUM. POTATO:

Scab (Actinomyces chromogenus): Washington, general on the coast.

Common scab (Actinomyces scabies): Twenty States reported scab. Maryland, Michigan, and Minnesota reported a higher prevalence than in an average year; Oklahoma and North Dakota less. The trouble is regarded as a limiting factor in production in sections of Kern County, California, because of soil infestation. Several reports noted the influence of low soil pH in control.

Early blight (Alternaria solani) was widely distributed as usual but there was considerable fluctuation in severity as may be seen from the following comments: Massachusetts, less than usual due to dry July and August; Connecticut, the usual amount, little damage, more than in 1935; New Jersey, common and severe throughout central and southern sections of the State on late crops; Delaware, much more than usual, very prevalent on late potatoes following storms and rainy weather; Maryland, more than usual, same as in

1935; North Carolina, general, but apparently did not cause serious loss in any area; Florida, only a trace, too dry; Louisiana, general; Texas; Michigan, came too late to cause defoliation but may have reduced tuber size to a small extent; Minnesota, less than in 1935 or in an average year, scattered traces, too hot and dry; Iowa, less than usual; North Dakota, less, scattered distribution; Colorado, much more than in 1935 or in an average year; Washington; California, not found serious.

Leaf spot (Ascochyta lycopersici), Oregon (P.D.R. 21:54).

Gray mold (Botrytis cinerea) on the leaves was reported from Connecticut where it did no damage in the one case noted. This is the first time it has been observed on potato in Connecticut.

Rhizoctonia (Corticium vagum) was reported as follows: Vermont, more than usual, in certification work noted more aerial tubers than usual, reduction in yield, 4 percent, loss in quality 3 percent; Massachusetts, both sprout rot and "rhizoc-hill" stages worse than usual. Seed treatment and shallow covering gave noticeable control, loss, 9 percent; Connecticut, recorded as damping off agent and in both Rhizoctonia and Corticium stages; New York; New Jersey, caused poor stands in some fields; Maryland, less than usual, same as last year, 3 percent; Florida, less, 4; Texas, 1; Michigan, less, 0.5; Minnesota, usual amount, less than in 1935, 3; Iowa, usual amount, 3; North Dakota, usual prevalence, less than last year, 1; South Dakota, prevalent locally, 2; Kansas, usual amount, less than in 1935, 5; Wyoming, more injury to small plants than in any one of the previous five years, loss 3; Colorado, usual prevalence, 1; Washington, prevalent in western Washington (P.D.R. 20:233).

Wilt (Fusarium oxysporum f. 1 and Fusarium sp.): New Hampshire; New Jersey; Maryland, less than usual, same as 1936, reduction in yield 1.5 percent, loss in grade, 1.5; Louisiana; Texas, trace; Michigan, same as in 1935, less than usual, 1; Minnesota, more than last year, much more than usual, chiefly in east central part of the State on lighter soils, 4; Iowa, usual 1 percent; North Dakota, the hot dry season seemed to favor wilt, especially late wilt; South Dakota, 10; Kansas, less than usual, only a very few cases seen; Wyoming and Colorado, each 1 percent; Washington.

Stem end rot (Fusarium solani var. eumartii): Michigan, less than usual, not a serious disease this year; Wyoming, more than usual, same as last year.

Fusarium dry rot (Fusarium spp.): Seed piece decay was general in Florida and more prevalent than usual, loss 0.5 percent. Dry rot caused 0.5 percent loss in Texas and 2 percent in Wyoming where F. sambucinum f. 6 (F. sulphureum) and F. trichothecioides were the organisms chiefly involved. Reports of dry rot were also received from Stevens County, Washington.

Late blight (Phytophthora infestans) was reported as follows: Vermont, less than usual, loss estimated at 7 percent was chiefly in the northeastern part of the State; Massachusetts, more than in 1935 but about the same as in average years, thorough program of dust or spray gave satisfactory control; Connecticut, less than average prevalence, only slight injury except in one late planted field; New York; New Jersey; Maryland, much less than in 1935, less than usual; eastern Virginia, in Princess Anne County, found in three small fields on the fall crop which is of minor importance; Florida, much more than in 1935, less than in many seasons, 4 percent loss; Texas; Michigan, only one known outbreak in a $2\frac{1}{2}$ acre field with about 25 percent infection of plants; Minnesota, conditions unfavorable to the disease; Iowa, none present; Kansas, none noted (it had been found in Kansas in 1935, the first authentic report); Wyoming, one specimen from an irrigated field sent in from Big Horn County; Washington; California, on the coast, reported bad at Santa Maria.

Sclerotinia rot (Sclerotinia sclerotiorum) caused the usual trace of loss in Florida.

Southern wilt (Sclerotium rolfsii) was less prevalent in Florida than in average years causing only a trace of loss. It occurred as usual in Louisiana and Texas.

Silver scurf (Spondylocladium atrovirens) was reported from New Jersey and Washington.

Verticillium wilt (Verticillium albo-atrum) was reported from New Jersey. Michigan recorded that no reports of its presence were received.

Black leg (Bacillus phytophthorus): Vermont, usual amount, 0.2 percent; Massachusetts, more prevalent; Connecticut, more than in 1935, usual amount, not serious; New Jersey; Maryland, trace; North Carolina, general, but higher prevalence in isolated areas may indicate that the organism persists in the soil; Florida, much more than usual but not very important; Texas; Oklahoma, less than average prevalence; Arkansas, trace; Michigan, some rotting in table stock fields late in the season after two weeks of rainy weather, loss 2.5 percent. Minnesota, Iowa, North Dakota, South Dakota, and Kansas each reported less than usual with loss of 1 percent or less. Wyoming estimated 1 percent reduction in yield and in addition 1 percent loss in quality. One field planted very early (late April) at Laramie showed 25 percent infection. Colorado observed the usual trace.

Bacterial wilt and brown rot (Bacterium solanacearum) was less prevalent than in 1935 in Florida. Reduction in yield was set at 0.5 percent and the total loss at 2.

Tuber rot (bacterial) was reported from Washington and California.

Stem nematode (?Ditylenchus dipsaci) was reported from Clark County, Washington. Root knot (Heterodera marioni) was reported from Texas and from Seattle, Washington.

Virus diseases: Giant hill occurred in Michigan in the usual slight amount. Leaf roll was reported to cause losses as follows: Vermont, 5 percent loss; Massachusetts, 3; New Jersey; Maryland, less, 2; Texas, 2; Michigan, 1; Iowa, 7; North Dakota, 1; South Dakota, trace; Washington, 5 to 10 percent was commonly noted in plantings made with certified seed. P.D.R. 20:233. Mild mosaic was reported from New Jersey; Michigan, trace; North Dakota, general, 1 percent. Rugose mosaic, Michigan, trace. Mosaic, Vermont, 3 percent loss; Massachusetts, since most acreage is planted with certified seed the damage is small, 3; Connecticut, more common than usual due to abundance of aphids; Maryland, less than usual, 1.5; Florida, 1; Texas, 3; Louisiana, 3; Iowa, 8; South Dakota, difficult to estimate because of hot, dry weather, 1; Kansas, usual trace; Wyoming, 2; Colorado, trace; California, noted at San Pablo and Colma. Spindle tuber was reported from New Jersey; Maryland, 0.5 percent; Michigan, trace; South Dakota, insect dissemination important last summer, 5; Kansas, 2; Wyoming, 1; California, occurred at San Pablo. Yellow dwarf occurred in Maryland, trace; Michigan, the disease has not increased in table stock fields, 0.2 percent loss; Wyoming, trace, 3 percent observed in a plot of Brown Beauty on the Agronomy Farm at Laramie. Miscellaneous viroses: West Virginia, witches' broom, 2 plants in 10 acres; Louisiana, a suspected virus disease under the name "hay wire" developed in the usual amount; Texas, curly dwarf, 2; Michigan, spindling sprout, 0.1, "moron" trace; Minnesota, viroses, 5; Washington, most home plantings were seriously affected with virus diseases.

Hopper burn and tip burn (leaf hoppers and drought): Vermont, 10 percent loss; Massachusetts, less, hoppers unusually scarce and late in appearing, 3; Connecticut, usual amount, complicated by aphid injury which was common, New York, hoppers very numerous and many potato tips wilted because of their activity; New Jersey, severe but not as bad as in 1935; Maryland, 1; Michigan, 5; Minnesota, less than last year, 5; Iowa, more prevalent, 5; Missouri, more than usual; North Dakota, hot dry weather seemed to favor hoppers more than usual; South Dakota, 10.

Psyllid yellows (due to injury caused by potato psyllid) was found at Colma, California, in October. This is the first report for California. (M. W. Gardner).

Internal brown spot (non-parasitic). Washington.

Seed tuber decay and poor germination were reported from New York, New Jersey, North Carolina, and Kansas.

Weather injury: Arkansas reported 26 percent reduction in yield due to drought. In Kansas potatoes left too long in the soil during hot weather developed black vascular bundles, especially noticeable after the tubers were stored a while. The black tissue was sterile.

SPINACH. See SPINACIA OLERACEA.

SPINACIA OLERACEA. SPINACH:

Downy mildew (Peronospora effusa): Massachusetts, trace; New York, prevalent on Long Island particularly in Nassau County; Maryland, 0.5 percent loss; southeastern Virginia, "Always present through the winter and until late April. Most damage on the fall crop this year", reduction in yield, 5 percent, loss in quality 10 percent; Texas, 3 percent; Washington; California.

Wilt (Fusarium solani), Texas, 2 percent. Wilt (Fusarium sp.) was prevalent in eastern Virginia where it is worse in old spinach fields and following late crops or seed crops. Crown rot (Fusarium sp.) caused 5 percent reduction in yield in the Baltimore truck growing section of Maryland. Damping off (Pythium sp., Rhizoctonia sp.), New York, New Jersey, and Virginia.

Virus diseases: Curly top was very severe in southwestern Texas, and in the Bend-Redmond area in Oregon (P.D.R. 21:51, 76). Mosaic was unusually prevalent in upstate New York late in the autumn, was present and severe on non-resistant varieties in Nassau County, and present during August and September in Richmond County; in Maryland it caused 2 percent loss. In California, a cucurbit mosaic type was present. Spotted wilt was bad at San Pablo, California.

SQUASH. See CUCURBITA MAXIMA.
SUMMER SQUASH. See CUCURBITA PEPO CONDENSA.
SWEET POTATO. See IPOMOEA BATATAS.
SWISS CHARD. See BETA VULGARIS CICLA.
TOMATO. See LYCOPERSICUM ESCULENTUM.

TRAGOPOGON PORRIFOLIUS. SALSIFY:

White rust (Albugo tragopogonis) was very common and probably destructive to the crop in New York. In Wisconsin it was scatteringly distributed and less prevalent than usual because of hot dry weather. It was also reported from Washington. Powdery mildew (Erysiphe cichoracearum), New York, "Plants rather severely infected in Richmond County, but actual loss (from defoliation) hard to differentiate from Sporodesmium leaf spot." Leaf spot (Sporodesmium scorzonerae), New York, "Percentage of infection very high in Richmond County but damage probably not as heavy as in 1934." Yellows (virus), New York reported this trouble present on Long Island but not serious.

TURNIP. See BRASSICA RAPA.
WATERMELON. See CITRULLUS VULGARIS.
WITLOOF. See CICHORUM INTYBUS.
YAM. See DIOSCOREA SATIVA.

# DISEASES OF SPECIAL CROPS

## ARACHIS HYPOGAEA. PEANUT:

Southern sclerotium rot (Sclerotium rolfsii) was prevalent in North Carolina especially in areas where peanuts, tobacco, and soybeans are grown in rotation. It is the most important factor in the root rot complex in that State (P.D.R. 20:348). It was generally present in all fields examined in Mississippi running as high as 10 percent in one field. Texas reported 1 percent.

Bacterial wilt (Bacterium solanacearum) appears to be increasing in areas where peanuts are grown commercially in North Carolina. This crop is less susceptible, however, than tomatoes or tobacco.

Leaf spot (Cercospora personata), Texas, 3 percent injury. Rhizoctonia stem rot (Corticium vagum) caused heavy loss of late planted peanuts throughout North Carolina, and was responsible for 1 percent loss in the Texas crop. (P.D.R. 20:348). Diplodia crown and nut rot (Diplodia natalensis) caused 2 percent damage in Texas. Wilt (Fusarium sp.) destroyed approximately 1 percent of the Texas crop. Root rot (Phymatotrichum omnivorum) reduced the Texas yield about 4 percent. Pythium sp. is reported as one of the organisms causing root rot in North Carolina (P.D.R. 20:348). Rosette (undetermined), Texas, trace.

COTTON. See GOSSYPIUM HIRSUTUM.

## GOSSYPIUM HIRSUTUM. COTTON:

Leaf spot (Alternaria sp.) appeared in the usual moderate prevalence in Louisiana where D. C. Neal states it always follows potash hunger. It caused a reduction in yield of 0.5 percent and 1 percent additional loss in grade. In some fields the total injury amounted to 50 percent. Texas also reported the disease.

Blight (Ascochyta gossypii) was reported only from North Carolina where it was observed in only one field, in Sampson County (P.D.R. 20:348).

Molds (Aspergillus spp.). Texas recorded traces of injury from green mold, A. flavus, and about 1 percent from black mold of the bolls caused by A. niger.

Leaf spot (Cercospora sp.) was present in the usual trace by mid-season in most Louisiana cotton fields according to D. C. Neal.

Damping off (Corticium vagum) caused serious injury resulting in poor stands in North Carolina and Louisiana. Ceresan treatment greatly improved stands in both States, and in some cases increased the yields (P.D.R. 20:347). Losses were estimated at 2 percent in Louisiana and Texas.

Boll rot (Diplodia gossypina /Physalospora rhodina/). Texas reported traces of loss from this disease.

Boll rot (Fusarium roseum), Louisiana, as usual, general but of slight importance, trace.

Wilt (Fusarium vasinfectum): A cotton wilt survey in the Coastal Plain area of Georgia is reported by A. L. Smith and H. W. Rankin (P.D.R. 20:342-346). In North Carolina the organism is present in the soils of a large number of farms especially in the eastern part of the State. The use of resistant varieties has reduced losses but there is still a large number of infested farms where wilt-resistant varieties are not planted and in addition the disease appears every year on farms where it has not previously occurred. In Mississippi, wilt was observed in 20 of 75 fields examined, varying in amount from a trace to 75 percent. In Louisiana, the reduction in yield was estimated at 3 percent. Certain strains of Dixie Triumph are recommended for the infested districts of this State. The loss in Texas was 6 percent. In Oklahoma, there was less than usual because of very dry and hot weather. In Arkansas, on the other hand, it was more abundant than for many years, especially in the eastern half, while in the drought area of the State there was less.

Anthracnose (Glomerella gossypii) was generally held in check by unfavorable weather. Losses were set at a trace except in Louisiana where the estimate was 2 percent.

Leaf spot (Mycosphaerella gossypina), North Carolina and Texas.

Rust (Puccinia schedonnardi). Texas reported this disease from several counties with the aecial stage commonly parasitized by Tubercularia persicina.

Root rot (Phymatotrichum omnivorum): Texas, 8 percent reduction in yield; Arkansas, traces in Little River County; Oklahoma, less than usual but more than in 1935.

Southern wilt (Sclerotium rolfsii) appeared scatteringly as usual in Louisiana causing a trace of loss.

Wilt (Verticillium albo-atrum). In 8 of 75 fields examined in Mississippi this wilt was present varying in amount from a trace to 35 percent. The disease also occurred in Texas and California.

Angular leaf spot (Bacterium malvacearum). North Carolina experienced serious damage from this disease about the time the plants started to bloom. Mississippi suffered little damage because of the dry, hot weather but this leaf spot was observed early in the season on as high as 25 percent of seedlings. In Louisiana, it was generally distributed as usual, loss 1 percent; Texas, 5, also present as a boll rot to the extent of 7 percent; Oklahoma, less than usual, too hot and dry; Arkansas, 1 percent.

Root knot (Heterodera marioni). Texas and Arkansas each estimated 1 percent reduction in yield from root knot.

Mosaic (virus) was observed in one county in Texas.

Crazy top (non-parasitic) was reported from Arizona and from California. It was much more prevalent than usual in California where it was observed 10 years ago by C. J. King, but this is the first time it has appeared serious enough to alarm growers. (C. E. Scott).

Miscellaneous troubles. A disorder reported as crinkle leaf and thought to be caused by a soil deficiency has been prevalent in a field at Baton Rouge, Louisiana, since 1934. The soil type is Lintonia silt loam. Lightning injury was observed in several areas in Mississippi. A trouble known as "double boll" and thought to be physiological, was observed in Texas as was a non-parasitic disorder reported as "strangulation".

HOPS. See HUMULUS LUPULUS.

HUMULUS LUPULUS. HOPS:

Sooty mold (Fumago vagans) was reported from Washington and Oregon as follows: Oregon--Douglas County, one report, variety unknown; Lane County, one report each on Early Clusters, Fuggles, and Late Clusters; Marion County, one report on Early Clusters, two on Late Clusters, and one on unknown variety; Washington County, one report on unknown variety. Washington--Yakima County, two reports on "Kentish", three on Late Clusters. (G. R. Hoerner).

Downy mildew (Pseudoperonospora humuli). On the Pacific Coast downy mildew was much more prevalent and severe than it had previously been observed to be. In Oregon, according to G. R. Hoerner, a reduction in yield of about half from the previous year's estimate was largely due to downy mildew. D. G. Milbrath made a similar report for Sonoma County, California. The average yield in the county was three bales per acre, while for the State it was eight bales. A considerable amount occurred in Mendocino County also but in the Sacramento Valley downy mildew was not an economic factor. C. Yarwood, from counts of systemically infected terminal and lateral shoots, estimated about 40 percent reduction in yield, caused by the general and severe infection in Sonoma and Mendocino Counties. Spring rains continuing later than in 1935 favored the development of the disease. In New York, according to R. O. Magie, downy mildew caused less damage than usual, although it was very prevalent in the form of "basal spikes" in all yards in early spring. (P.D.R. 20:262; 21:8, 9).

Powdery mildew (Sphaerotheca humuli), according to R. O. Magie, was a minor factor in hop production in New York where it is usually very important (P.D.R. 20:262).

Crown gall (Bacterium tumefaciens) was reported from Oregon in Linn and Josephine Counties on an unknown variety (G. R. Hoerner).

Obscure disease (apparently virus). Serious infection in all yards over a year old was reported from Oneida County, New York, by R. O. Magie. The symptoms vary according to variety, culture, and the development of the plant (P.D.R. 20:262).

Dormant hills and missing hills both of unknown cause were reported from Yakima County, Washington, in each case once on an unknown variety. In Oregon a root rot likewise of undetermined origin was observed once on an unknown variety in Marion County (G. R. Hoerner).

MENTHA spp. MINT:

Rust (Puccinia menthae): Massachusetts, epiphytotic on cultivated mint during the past season; Connecticut, on cultivated spearmint (M. spicata); New Jersey. Wilt (Verticillium sp.) was much more prevalent than usual on peppermint (M. piperita) in Michigan according to Ray Nelson. Drought conditions and high temperatures in July and August provided especially favorable conditions for wilt. It was controlled by maintaining a high water table. The reduction in yield is estimated at 10 percent, the loss in grade at 10 percent.

NICOTIANA TABACUM. TOBACCO:

A very full report by the Tobacco Disease Survey Committee on the tobacco diseases in 1936 has been given in The Reporter (P.D.R. 21:44-50), as well as various State summaries, as follows: Florida (20:172-173); Kentucky (20:188-189); Georgia (20:142); Virginia (P.D.R. 21:27-29); Wisconsin (P.D.R. 20:189-190, 284-285).

Brown spot (Alternaria longipes) was widespread on late tobacco in the Old Belt of Virginia and North Carolina, was conspicuous in South Carolina, and observed in Pennsylvania.

Frog eye (Cercospora nicotianae) was reported as present but apparently not important in Florida, Kentucky, North Carolina, and Puerto Rico. In Kentucky the organism caused a green spot or barn spot in cured tobacco in both 1935 and 1936 in places where Burley tobacco was exposed to fog before cutting or in the barn, according to W. D. Valleau.

Damping off or sore shin (Corticium vagum) was widely reported. In North Carolina it was general and severe in both plant bed and field; in Virginia, South Carolina, and Kentucky it caused heavy field losses locally. In Connecticut, Pennsylvania, Georgia, and Wisconsin damping off occurred but was not important.

Fusarium wilt or yellows (Fusarium oxysporum nicotianae) was observed in one field in Lee County, Virginia, for the first time in the State. In Kentucky it has frequently been reported during the last three years in sandy land along rivers, especially the Ohio. In North Carolina it was found in small areas in Onslow and Columbus Counties. On one farm it was severe in a field that had never been planted to tobacco before. W. D. Valleau in Kentucky reported the varieties Burley 31 and 32 as very resistant, all dark tobacco varieties tested as resistant, and all commonly grown Burleys as very susceptible.

Downy mildew (Peronospora tabacina) was not important in 1936, probably due to generally hot dry weather. It apparently occurred throughout most of its established range although it was not reported from Tennessee. It appeared in Kentucky for the first time, in five plant beds in Todd County.

Damping off (Pythium debaryanum) was reported from Georgia and Wisconsin as present but unimportant. The trouble was general and serious in Puerto Rico during the rainy season.

Black shank (Phytophthora parasitica nicotianae) was important on susceptible varieties in Gadsden County, Florida, but since resistant varieties are mostly grown losses were small. The organism caused some leaf spotting during a period of damp weather but with negligible loss. Some spread was noted in North Carolina. Results obtained on farms where four or five year crop rotations have been used indicate that the disease can be controlled by this means. W. D. Valleau reported that no infected planting was seen in western Kentucky in 1936 but that E. M. Johnson observed black shank in one field in northern Tennessee. The disease was also reported from Puerto Rico.

Stem rot (Sclerotium rolfsii) continued to be important in North Carolina in areas where peanuts, soybeans, and tobacco are grown in rotation. It also developed in light soils in fields where the rotation consists of general crops.

Black root rot (Thielaviopsis basicola) was generally reported as present early but causing little loss because warm weather during the growing season permitted plants to recover. In the Burley section, Kentucky growers have learned the value of resistant varieties and as a consequence losses are light. Burley 16, introduced two years ago, seems to be a valuable variety. Burley 5 is also very resistant. Black root rot has not caused serious loss in North Carolina for five years, even on soils where heavy infestation is known to exist.

Hollow stalk (Bacillus aroideae) was of slight importance in Virginia and North Carolina.

Angular leaf spot, blackfire (Bacterium angulatum) occurred in Massachusetts, but did little damage. The usual trace of loss was reported from Maryland. Much less than usual developed in Kentucky where losses were estimated at 3 percent. In North Carolina the disease was widespread and caused much greater damage than during the previous seven years. It was present in about 50 percent of the seed beds in Wisconsin and there was also considerable late field infection.

Bacterial wilt (Bacterium solanacearum) developed alarmingly in North Carolina. It seems to be spreading in all important districts. The losses in the eastern part of the State were greater than in any of the previous 7 years.

Wild fire (Bacterium tabacum). Massachusetts, traces only, "Careful attention to seed beds and inspection to prevent transplanting infected seedlings prevents the disease being scattered"; Pennsylvania, "about the usual prevalence, control measures have in some 70 cases reduced the percentage of infection from 80 to approximately 20. Loss in yield and quality estimated at 2.5 percent"; Maryland, the usual prevalence and loss of 2.5 percent; Kentucky, scattered occurrence in the southern tier of counties and in the western part of the State, loss slight; Wisconsin, less than usual, found on only five farms in Rock County.

Mosaic (virus): Massachusetts, very little in seed beds, prevalent in fields but no serious losses; Connecticut; Pennsylvania, much more than usual, almost reached the stage of an epiphytotic, reduction in yield 8 percent, loss in quality 2; Maryland, less than in 1935, loss in yield and grade, 5 percent; Kentucky, "Much more prevalent than usual but growers are gradually beginning to realize that mosaic is a disease and that it can be controlled by keeping the hands free from barn cured tobacco while handling the crop, good results in control" Valleau; North Carolina, unusually light this year, but in some fields 100 percent infection and severe damage occurred; Georgia, mosaic was not seen in plant beds and occurred only after the crop had been put in the field; Wisconsin, less than usual of the ordinary tobacco mosaic and little or no infection with cucumber mosaic virus; Puerto Rico, general.

Other virus diseases: Traces of ring spot appeared in Maryland as usual. Very little was seen this year in Kentucky. Spotted wilt occurred at Berkeley, California, on Nicotiana tabacum and on N. sylvestris. Streak, Wisconsin. See P.D.R. 20:285.

Brown root rot (undetermined cause) was rare in Wisconsin. It is likely that drought and perhaps high soil temperatures were instrumental in reducing the severity and masking the effects of the disease.

Sand drown (non-parasitic) was common in some plant beds and in many fields in North Carolina.

Miscellaneous troubles. See P.D.R. 20:136, 172, 285.

PEANUT. See ARACHIS HYPOGAEA.
PEPPERMINT. See MENTHA spp.
TOBACCO. See NICOTIANA TABACUM.

# DISEASES OF SUGAR CROPS

## BETA VULGARIS. SUGAR BEET:

SUGAR BEET DISEASES IN 1936, by G. H. Coons, Division of Sugar Plant Investigations.

Eastern Area: In eastern United States, chief disease losses were restricted to usual types of loss arising from poor stands due to damping off (various fungi) but losses from this source were less than normal because of rather favorable spring conditions. In Minnesota, damping off was reported of minor importance and less than the previous season, the months of April and May being very dry.

Leaf spot was prevalent in Michigan and Ohio, but caused less damage than in 1935, the peak of the epidemic not occurring until the middle of September. Loss in the eastern area was probably less than 5 percent, estimate for Minnesota being placed at 2 percent.

Root rot (crown rot) due to *Rhizoctonia* was general throughout the eastern area, causing in most fields minor damage. Occasional fields were found in which the loss reached important proportions. Because of general tendency for the disease to occur late and reduce yields more than is suspected, it is probable that losses amounting to at least 2 percent of the crop accrue from this disease through destruction of half-grown to nearly mature plants.

Phosphate deficiency was recognized in the Chaska area in Minnesota. Boron deficiency was found serious in a few fields in Michigan, and doing minor damage over a rather large area in central Michigan.

Other diseases: Savoy (virus) was found again in Michigan, Ohio, and Minnesota, causing minor damage. In a few fields as many as 5 percent of the plants were affected, but in general its incidence was less than 1 percent. Loss from *Phoma betae* as a root rot was placed at 1 percent in Minnesota. *Rhizoctonia* spp., dry rot, apparently of the deep canker type reported by Richards and others from western United States, was found for the first time in two fields in Minnesota.

Western United States: The chief disease losses in beet areas of the plains states and Colorado, where beets are grown under irrigation, have been produced by leaf spot, *Cercospora beticola*, and sugar-beet nematode. The loss from leaf spot in northern Colorado was placed at 3 percent and for southern Colorado (Arkansas Valley), 10 percent. The epidemic reached its height later than usual; was general in occurrence. It was first recorded on July 1 in the Fort Collins area, and on July 15 in the Arkansas Valley. Factory estimate in the Arkansas Valley attributed lowering of sucrose percentage in the sugar beets processed at 1 percent; loss of immature beets by rotting in storage was also attributed in part to this disease.

Sugar-beet nematode (Heterodera schachtii) was reported as doing 1 percent damage, with 50 percent infection maximum noted in any field. Avoidance of infested fields and long rotations continue to keep this disease from assuming serious proportions, since nematode is widely distributed in many areas.

Damping off in this area was minor, some correlation with previous crops and weed host plants being noted, sugar beets following legume crops or planted in fields known to be foul with Amaranthus showing poor stands.

Root rot (Rhizoctonia) was general, and in a few fields caused almost 100 percent damage. In northern Wyoming, this disease was serious in many fields, original stands being poor and loss of nearly mature plants heavy. A 2-crop rotation of alfalfa and beets is commonly followed in this section.

Savoy was found in Nebraska, South Dakota, Colorado, and Wyoming. Distribution was general but as a trace in nearly all fields examined.

Sugar-beet yellows, previously reported for Colorado, was found again in Colorado, and noted for the first time in Nebraska, South Dakota, and Wyoming. Loss caused minor.

Curly top, which normally is present only as a slight trace in the Arkansas Valley of Colorado, was more prevalent in that area than had previously been noted. The disease appeared late, and the loss was estimated at less than 1 percent. Maximum infection noted in any field was 90 percent; heaviest incidence was noted in fields at the edges of the Valley nearest the dry lands.

In the areas west of the Rocky Mountains, recognized as the area in which curly top occurs every year, the outbreak was less than in 1935. Because of general use of curly-top-resistant varieties, losses from this source were greatly alleviated. Estimates of curly-top damage to resistant varieties under the light attack of 1936 were placed at less than 1 percent for Utah. In California (San Joaquin and Salinas Valleys), the average loss was about 1 ton to the acre with curly-top-resistant varieties. Had European brands not resistant to curly top been similarly exposed, the loss in the Salinas area might have been from 2 to 6 tons per acre, dependent upon date of planting. On a corresponding basis, losses in the San Joaquin Valley, had European brands been used, would possibly have been from 6 to 12 tons per acre.

In Idaho and Washington, curly top was much less severe than it often is, and damage to resistant varieties, which were used almost exclusively, was from a negligible amount to 1 ton per acre. The indications are, from rather limited test plantings, that with European brands the losses, while negligible in some areas, would have been nearly complete in others.

Downy mildew (*Peronospora schachtii*) and beet rust (*Uromyces betae*) caused considerable damage to sugar beets in California coastal areas.

SACCHARUM OFFICINARUM. SUGAR CANE:

NOTES ON SUGAR CANE DISEASES IN 1936, by E. V. Abbott, Division of Sugar Plant Investigations.

Red rot (*Colletotrichum falcatum*). Due to more general planting of resistant varieties, germination failures from red rot were generally less in Louisiana in 1936 than in previous years. Severe injury was limited largely to the very susceptible C.P. 807 on heavy soils. Stands of the moderately susceptible C.P. 28/19 were below normal, but this resulted more from the extreme drouth after planting in the fall of 1935, and from *Cytospora* (see below), than from red rot. The use of resistant varieties has reduced red-rot injury to mill cane to near the minimum which may be expected.

Red rot caused the usual loss of 25 to 50 percent of banked Cayana seed cane in the sirup-producing states, while other varieties were little affected.

Cytospora rot (*Cytospora sacchari*). The first records of important germination reductions by this disease in Louisiana occurred in 1936. Injury varied greatly with planting conditions, but was generally greatest on heavy soils, and where the cane had been planted under extreme drouth conditions in 1935. C.P. 28/19 and C.P. 807 were most adversely affected, estimates of stand reductions varying from 10 to 35 percent. Injury to the red-rot resistant Co. 281 was also noted. The presence of red rot and pineapple disease (*Thielavia paradoxa*) in most fields made impossible an exact estimate of the loss from any one disease.

*Cytospora* was common also on the upper portions of the stubble rhizomes of several commercial varieties (principally C.P. 807, 28/19, 29/320, and Co. 281), but probably caused little stand reduction.

Calico (non-parasitic, probably physiological) attracted considerable attention in 1936 because of its widespread occurrence on C.P. 28/11 in the early summer. The plants recovered and apparently were not adversely affected.

Pokkah bong (*Fusarium moniliforme*), red stripe (*Bacterium rubrilineans*), mottled stripe (*B. rubrisubalbicans*), brown stripe (*Helminthosporium stenospilum*), and black rot (*Ceratostomella adiposum*). Traces.

SUGAR CANE MOSAIC SITUATION IN 1936, by Eaton M. Summers, Division of Sugar Plant Investigations.

The most intense mosaic spread in at least ten years occurred in Louisiana in 1936. Small plots of initially healthy plant cane of the variety Co(imbatore) 281, exposed to natural infection from large surrounding areas of diseased cane, became over 70 percent mosaic by August, as compared with a maximum of 17 percent for any previous comparable period. Although Co. 281 is more resistant to mosaic infection than the formerly grown Louisiana Purple, D(emerara)-74, and P.O.J. varieties, it has gradually become heavily diseased as a result of a series of years of unusually heavy spread, the worst of which was, undoubtedly, 1936.

The damage from mosaic was, however, confined to the 25-40 percent of the total cane area which is cultivated with this variety. Mosaic resistant varieties are now grown on the remaining acreage. Of these, C(anal) P(oint) 28/11, C.P. 28/19, C.P. 29/116, C.P. 29/320, and C.P. 807 (now declining rapidly in acreage) seldom show more than a trace of mosaic and frequently none at all. Co. 290 shows from a trace to as much as, occasionally, 60 or 75 percent, but is, apparently, not greatly injured. Fields of Co. 281, the most indispensable variety of the lot because of its resistance to deterioration and inversion of sucrose when windrowed (so important in Louisiana during the latter half of the grinding season), are often 100 percent mosaic, particularly in the main area of the Sugar Bowl. It is conservatively estimated that such fields suffer a loss of at least 10 percent in sugar yield due to mosaic.

Seed selection and roguing for control of mosaic was recommended by the Department of Agriculture in 1933 when most of the fields of Co. 281 showed only 0-10 percent infection. The results obtained by those who heeded this warning indicate that general adoption of such measures would have partially, or largely, averted the present crisis. One company that practiced only mass selection of fields that showed the least mosaic has kept infection in their successive plantings down to negligible percentages. Neighboring fields, under other management, where no seed selection of any kind was practiced are now nearly 100 percent mosaic.

The alternate recommendation of isolation and roguing of seed plots has met with varying degrees of success depending upon the thoroughness and timeliness of the work. Considerable acreages of Co. 281 were planted in 1936 with seed cane from such rogued seed plots which had been planted the previous year with selected cane. Many of these plots contained only a very small percentage of mosaic. Increased interest in mosaic control is now manifest by the several hundred acres of seed plots to be rogued in Louisiana in 1937. Even though mosaic-free Co. 281 yields considerably less sugar than most of the other commercial varieties now grown, it must, however, be retained for planting 25-40 percent of the total Louisiana sugar cane acreage until a better variety with equal windrowing quality is produced. Therefore, more widespread effort to decrease the mosaic toll in this variety seems entirely justified.

SUGAR BEET. See BETA VULGARIS.
SUGAR CANE. See SACCHARUM OFFICINARUM.

# DISEASES OF TREES

Attention is called to the fact that the following very condensed summary of the incidence of tree diseases in 1936 does not include all diseases reported during the year. For the most part it lists only reports indicating some variation in occurrence from previous years and not already quoted in the Reporter. Many diseases for which reports indicate little or no change from the usual condition are omitted.

Tree diseases were the subject of a number of articles in the Reporter, of which those cited in the accompanying list are of a somewhat general nature and are not referred to again in this summary unless some additional information makes it desirable to do so in a particular case. Besides these articles, the indexes to Volumes 20 and 21 of the Reporter should be consulted in connection with this summary.

Carter, J. C. Leaf diseases of nursery stock in Illinois in 1936. Reporter 21: 115-118.

Crandall, Bowen S. Rhizoctonia on tree seedlings. Reporter 21: 82.

__________ Root disease of some conifers and hardwoods caused by Phytophthora cambivora (P. cinnamomi). Reporter 20: 202-204.

Harrar, J. G. Powdery mildews collected in Virginia. Reporter 20: 278-279.

Hilborn, M. T., and F. H. Steinmetz. Some epixylous fungi of Maine. Reporter 20: 306-309.

McKenzie, Malcolm A. Tree diseases in Massachusetts. Reporter 21: 55-58.

Pierson, R. K., and John Ehrlich. Effects of the autumn 1935 cold wave on forest trees in northern Idaho. Reporter 21: 64-65.

Ruehle, Geo. D. An epiphytotic of algal spot in south Florida. Reporter 20: 221-222.

Steinmetz, F. H. Occurrence of rusts on cedars in Maine. Reporter 20: 174-175.

__________, and A. E. Prince. Additional Gymnosporangium rusts in Maine. Reporter 21: 234-235.

Waterman, Alma A. Diseases of shade and ornamental trees: Summary of specimens received in 1935 and 1936 at the New Haven Office, Division of Forest Pathology. Reporter 21: 33-37.

Woodbury, George W. Effects of the autumn 1935 cold wave on ornamentals in northern Idaho. Reporter 21: 66.

Wright, Ernest. Deciduous-seedling diseases in midwest nurseries. Reporter 21: 80-81.

ACER

Cylindrosporium negundinis, leaf spot. Iowa.

Gloeosporium apocryptum, anthracnose. Said to be less prevalent than usual in States reporting, with dry weather mentioned as a possible factor. Reported from Washington on boxelder.

<u>Phymatotrichum omnivorum</u>, Texas root rot. Texas as usual. Also reported from San Diego County, California, on boxelder.

<u>Poria spissa</u>, wood rot, New Hampshire.

<u>Rhytisma acerinum</u>, tar spot. Said to be less prevalent than usual in States reporting it.

<u>R. punctatum</u>, tar spot. Massachusetts, on <u>A. spicatum</u>, "Least seen in years".

<u>Schizophyllum</u> sp., wood rot. New Hampshire.

<u>Taphrina</u> sp., leaf blister. Prominent spotting of maples throughout North Carolina.

<u>Verticillium</u> sp. (also reported as <u>V. albo-atrum</u>, <u>V. dahliae</u>), wilt. Connecticut; Massachusetts, "More maples were removed than usual, apparently because dry weather caused death of wilt-affected trees"; New York, on <u>A. platanoides</u>: New Jersey, on <u>A. rubrum</u> and <u>A. saccharum</u>; Pennsylvania, on <u>A. platanoides</u>, mostly in the southeastern part of the State; Virginia, on <u>A. platanoides</u> and <u>A. saccharum</u>; West Virginia, "On <u>A. platanoides</u> in Marion County. In one case on young trees about 12 years old which have been growing well. Sections show borer injury several years ago. Another case on 35-year-old trees"; Michigan, "About the same number of cases determined by tissue plantings as in 1935. All cases in cities or towns."

AESCULUS HIPPOCASTANUM

<u>Guignardia aesculi</u>, leaf blotch. Reported from the usual range, apparently less prevalent than usual. In Connecticut leaf blotch itself was reported only once but a similar trouble due to sun scorch was not uncommon.

<u>Sphaeropsis</u> sp., blotch. New Jersey.

ALEURITES

A number of diseases of tung-oil tree were reported from Louisiana, mostly as of slight or moderate importance, including branch canker and nut rot caused by <u>Dothiorella</u> (<u>Botryosphaeria</u>) sp., and crown girdle, interveinal browning, translucent spot, and white tree, all of undetermined cause. Crown rot caused by <u>Diplodia natalensis</u> was reported from Texas. In southern Mississippi numerous trees died from an undetermined cause. (P.D.R. 20: 263).

BETULA

<u>Hypoxylon marginatum</u>. Mississippi (host doubtful).

<u>Nummularia punctulata</u>. Mississippi.

CASTANEA

<u>Endothia parasitica</u>, blight. Recurrence was reported from California on <u>C. dentata</u> in the plantings in which it was found previously.

<u>Penicillium</u> sp., mold. Washington.

CASTANEA PUMILA

*Endothia parasitica*, blight. Virginia.

CATALPA

Mosaic, reported as due to virus. Washington.

CELTIS

*Cylindrosporium* sp., leaf spot. Iowa, in nurseries.

CINNAMOMUM CAMPHORA

*Armillaria mellea*, mushroom root rot. Sacramento County, California. First report on this host to Plant Disease Survey.

COTINUS COGGYARIA

*Verticillium* sp., wilt. Virginia (P.D.R. 21: 10).

CRATAEGUS

*Bacillus amylovorus*, fire blight. Less than usual in Massachusetts. Reported from New Jersey. Causing serious loss of blossoms in North Carolina, resulting in very low fruit production.

*Entomosporium thuemenii*, blight. Washington.

*Fabraea maculata*, blight. Connecticut, severe in the one case reported.

*Gymnosporangium* sp., rust. Washington.

*G. clavipes*, quince rust. Connecticut, New York, Pennsylvania, Virginia.

*G. globosum*, hawthorn rust. Massachusetts and Wisconsin, less than usual in both States.

EUCALYPTUS

*Hendersonia eucalypti* and *Phyllosticta extensa*, associated with leaf spot and twig canker. Common near Half Moon Bay, California, in January.

ILEX

*Phomopsis* sp., canker. Western Washington, at Puyallup and Olympia.

Frost injury. Washington.

JUGLANS CINEREA

*Gnomonia leptostyla*, leaf spot. New York.

*Melanconium oblongum*, blight. West Virginia.

JUGLANS NIGRA

*Gnomonia leptostyla*, leaf spot. Michigan, "Less than last year and much less than usual, probably because of the dry summer. Difficult to find until late in September. None was found on the three butternut (*J. cinerea*) trees examined in separate localities."

Dying due to heat and drought. Kansas, "A very large percentage of the walnut trees have died because of drought and heat. In many forest-tracts 100 percent of the walnut trees are dead."

JUNIPERUS SP.

*Gymnosporangium clavariaeforme*, rust. Connecticut, one report.
*G. clavipes*, quince rust. New Jersey.
*G. juniperi-virginianae*, apple rust. Massachusetts, New Jersey, Pennsylvania, Delaware.

JUNIPERUS COMMUNIS

*Gymnosporangium clavariaeforme*, rust. Wisconsin, in Columbia County; Maine, on *J. communis depressa* (prostrate juniper).
*G. clavipes*, quince rust. Maine, on *J. communis depressa*.

JUNIPERUS HORIZONTALIS

*Gymnosporangium juvenescens*, rust. Maine.

JUNIPERUS VIRGINIANA

*Gymnosporangium clavipes*, quince rust. Massachusetts, Connecticut, New York, New Jersey, Georgia, South Carolina.
*G. globosum*, hawthorn rust. Maine, Massachusetts, New York.
*G. juniperi-virginianae*, apple rust. Maine, Massachusetts, Connecticut, New York, New Jersey, Texas, Wisconsin, Kansas. In several cases said to be less prevalent than usual. In Kansas, "The galls were again very small although not so small as in 1935, and there were not so many galls per tree as in 1935."
*G. nidus-avis*, rust. Maine, Georgia.

LIRIODENDRON TULIPIFERA

*Phyllosticta liriodendrica*, leaf spot. Massachusetts, "Prevalent, but appeared late and caused far less defoliation than usual."

NYSSA SP.

*Septobasidium curtisii*. Mississippi.

PICEA SPP.

*Chrysomyxa cassandrae*, needle rust. Wisconsin, on *P. mariana*.
*Cytospora kunzei*, canker. (P.D.R. 21: 35, 55).
*Melampsorella cerastii*, rust. Wyoming on *P. engelmannii*.
*Pythium debaryanum*, damping-off. New Jersey.
*Rhizoctonia solani*, damping-off. Connecticut, on *P. excelsa*.
Tip blight, needle blight, caused by winter injury. New Jersey, Washington.

PINUS SPP.

*Capnodium pini*, sooty mold. Connecticut, one report on *P. strobus*.
*Ceratostomella pini* or *C. ips*, blue-stain. Pennsylvania.
*Coleosporium campanulae*, rust. New York, on *P. sylvestris* (P.D.R. 20: 358-359).
*C. solidaginis*, rust. Massachusetts (P.D.R. 20: 303); Connecticut, one report on *P. rigida*, four on *P. resinosa*; New Jersey.
*C. vernoniae*, rust. Texas, on *P. palustris*.

Cronartium comptoniae, rust. Massachusetts, on P. rigida and P. sylvestris; Connecticut, "One report on P. sinensis, a new host for the State. Produced II and III stages on sweet fern on inoculation."

C. quercuum, rust. Pennsylvania, Mississippi, and on P. banksiana in Wisconsin.

C. ribicola, white pine blister rust. The outstanding fact with regard to this disease in 1936 was its discovery for the first time on the very susceptible and very important sugar pine, P. lambertiana, within its natural range, in Oregon first and then in California. In Oregon the disease was first found in April on the Metolius River in Jefferson County and in the Siskiyous less than sixty miles from the California border near the boundary between Coos and Curry Counties. The first case of white pine blister rust ever to be reported for California was found during June in Del Norte County in the Siskiyou National Forest, on a single young sugar pine. Additional infections on sugar pine were found later in both States. For details of these discoveries see P.D.R. 20: 173-174, 220-221, 296; and also Supplement 99: 25-35, where a complete account of blister rust control and scouting activities during the year is given.

Cucurbitaria pithyophila, canker. Washington, on P. monticola in Spokane County.

Neopeckia coulteri, brown felt blight. Wyoming, on P. contorta.

Sphaeropsis malorum, leaf injury. Connecticut, one report on P. nigra (Austrian pine), complicated with weather injuries.

PLATANUS

Ceratostomella sp., trunk canker. Pennsylvania, less prevalent than usual.

Gnomonia veneta, anthracnose. Massachusetts, "Severe attack this year, many trees 75 percent defoliated early in the season"; Connecticut, less than usual; New Jersey; Pennsylvania, "About as usual, occurs in cities on occasional trees"; Mississippi (P.D.R. 20: 194); Michigan, "Less than usual and less than in 1935. Early weather warmer and dryer. The disease occurs generally in the southern half of the State in the range of the host"; Kansas, much less than usual and less than last year.

Microsphaera alni, powdery mildew. Delaware, New Jersey.

POPULUS

Bacterium tumefaciens, crown gall. Texas, Wisconsin.

Cytospora sp. plus winter injury causing canker or dieback. Washington.

Cytospora chrysosperma, canker. Reports did not indicate any especial change from the preceding year. In Iowa there was less than usual on P. dentata.

Dematophora sp., root rot. California, on nursery trees of Lombardy poplar in Alameda County.

Dothichiza populea, canker. Massachusetts, "More serious since many infected trees died during the dry summer. All plantings of Italian and Turkestan poplars seriously infected." Also reported from Rhode Island on Lombardy poplar, New Jersey, and from Wisconsin where there was less than last year.

"? Hypoxylon sp., canker, probably the same as reported from Michigan, is spreading in Wisconsin. No laboratory determination made."
H. pruinatum, canker. Massachusetts, slight injury.
Marssonia sp., canker. California, in San Joaquin and Merced Counties.
Sphaeropsis sp., canker. "All plantings of Italian and Turkestan poplars in Massachusetts are seriously infected."
Taphrina johansonii, catkin disease. New Hampshire on P. tremuloides.
Mosaic mottle (? virus). Washington, at Wenatchee.

PRUNUS

Bacterium pruni, bacterial spot. Delaware, "Foliage and twig infection on Prunus 'Othello', first report on this host. Found in a nursery planting in October." Illinois, on P. virginiana (P.D.R. 21: 116).
Dibotryon morbosum, black knot. Connecticut, on wild cherry; California, on P. demissa.
Podosphaera oxyacanthae, powdery mildew. Virginia (P.D.R. 20: 279).
Sclerotinia fructicola, brown rot. Minnesota "Moderate infection seen in September on bushes of P. japonica at the Fruit Breeding Farm. Host grown but little."

PSEUDOTSUGA TAXIFOLIA

"Stem twister". West Virginia, "Four trees in a nursery at Parkersburg affected in 10 percent of the twigs. Injury first noticed in April but probably occurred in 1935."

QUERCUS

Armillaria mellea, mushroom root rot. Massachusetts, "Most sporophores seen in ten years"; Wisconsin, "About as usual, secondary to drought injuries."
Endothia gyrosa. Mississippi.
Gnomonia veneta, anthracnose. Reported from Massachusetts, New Jersey, Michigan, and Wisconsin, as less prevalent than usual.
Marssonia martini, leaf spot. Mississippi, on Q. prinus.
Monochaetia desmazierii, leaf spot. One report on white oak, Q. alba, in Connecticut, associated with Taphrina coerulescens.
Polyporus hispidus, heart rot. West Virginia, "Trees in one area on Chestnut Ridge, Monongalia County, are heavily infected. Infection is always accompanied by cankers upon which the sporophores appear. All oaks seem to be attacked."
Sphaeropsis sp. New Jersey, on Q. prinus.
Strumella coryneoidea, canker. Continues to be fairly prevalent in Massachusetts, on black oak.
Taphrina coerulescens, leaf blister. Connecticut, on Q. alba; North Carolina, "Widely distributed and caused much alarm because of the serious blighting effects. Different kinds of oaks vary in susceptibility"; Mississippi; Texas, on Q. palustris and Q. virginiana; Illinois on Q. alba; Wyoming, on Q. gambellii in the Sierra Madre Mountains.

SALIX

Armillaria mellea, mushroom root rot. California, in Los Angeles County.
Bacillus sp. reported as causing a blight. New Jersey.
Cytospora chrysosperma, canker. Connecticut, Wisconsin.
Fusicladium saliciperdum, scab. Very destructive in Maine. In Massachusetts there was less because of dry weather. Also reported from Connecticut and New Jersey.
Marssonia salicis, twig blight. Less serious than usual but still prevalent in Massachusetts.
Physalospora miyabeana, black canker. Reported on pussy willows from Berkeley, Kanawha, and Marshall Counties, West Virginia.
Valsa leucostoma, twig canker. Less prevalent in Massachusetts.

SCHINUS MOLLE

Cuscuta subinclusa, dodder. Heavy infection of trees near Los Angeles, California, causing death of two in one location. (P.D.R. 21: 11).

SEQUOIA GIGANTEA

Pestalozzia sp., associated with die-back. Los Angeles County, California. (P.D.R. 21: 79).

SORBUS AMERICANA

Bacillus amylovorus, fire blight. Connecticut, Illinois.
Sphaeropsis sp., New Jersey.
Venturia inaequalis cinerascens (Fusicladium orbiculatum), scab. Illinois.
Dieback caused by winter injury plus Cytospora invasion. Spokane, Washington.
Stem canker caused by sunscald. Iowa, caused 75 percent loss in a nursery.
Winter injury. Connecticut, one report, may have been complicated with previous dry weather.

TAXUS

Sphaeropsis sp., twig blight. New Jersey.

THUJA

Phytophthora sp., tip blight. New Jersey, Middlesex County.

ULMUS

Cephalosporium sp., wilt. Massachusetts (P.D.R. 21: 58-59). Connecticut, "Isolated in culture from nineteen reports, scattered over the State, in Windham, Hartford, Litchfield, Middlesex, New Haven, and Fairfield Counties."
Ceratostomella ulmi, Dutch elm disease. See various notes in the Reporter, and Supplement 99: 18-25.
Coniothyrium ulmi, leaf spot. Iowa.
Gloeosporium inconspicuum, leaf spot. Iowa, in nursery.
Gnomonia ulmea, black leaf spot. Few reports were received, and none indicating injury.

Phyllactinia corylea, powdery mildew. Caused severe premature defoliation throughout North Carolina.
Polyporus squamosus. On trunk of injured U. americana in Connecticut.
Sphaeropsis sp., canker. Less than usual in Wisconsin.
Verticillium sp., wilt. Massachusetts (P.D.R. 21: 58-59); Connecticut, "Eight reports from cultures, in Windham, Hartford, New London, New Haven, and Fairfield Counties"; Indiana (P.D.R. 21: 37).
Mosaic (virus ?). New York, on Long Island; Virginia. (P.D.R. 20: 227).

## DISEASES OF ORNAMENTAL AND MISCELLANEOUS PLANTS

What was said in the introductory statement to the section on Tree Diseases applies to this section also.

Carter, J. C. Leaf diseases of nursery stock in Illinois in 1936. Reporter 21: 115-118.
Guba, E. F. Plant disease notes from Massachusetts. Reporter 20: 302-303.
Harrar, J. G. Powdery mildews collected in Virginia. Reporter 20: 278-279.
Huber, Glenn A. Plant diseases in western Washington. Reporter 20: 332-333.
Jones, Leon K. Observations on plant diseases in Washington in 1936. Reporter 20: 230-236.
Linn, Manson B. A list of diseases found on economic plants on Staten Island (Richmond County), New York from 1932 to 1936. Reporter 21: 73-76.
Pirone, P. P. Diseases of herbaceous ornamentals in New York in 1936. Reporter 20: 324-326.
Ruehle, Geo. D. An epiphytotic of algal spot in south Florida. Reporter 20:221-222.
Schmidt, Robert. Relative susceptibility of certain varieties of dahlias to root-knot nematode. Reporter 21: 32-33.
Woodbury, George W. Effects of the autumn 1935 cold wave on ornamentals in northern Idaho. Reporter 21: 66.
Yarwood, Cecil E. Unreported powdery mildews. Reporter 21: 80-182.

ABELIA

Heterodera marioni, root knot. California, Alameda County.

ACONITUM

Sclerotium delphinii, root and crown rot. New Jersey.
Heterodera marioni, root knot. Vermont. (P.D.R. 20: 324).

AGERATUM

Sclerotium delphinii, crown rot. New Jersey.

AJUGA

Sclerotium delphinii, crown rot. New Jersey (P.D.R. 20: 198).

ALTHAEA ROSEA

Cercospora althaeina, leaf spot. Collected at Ithaca, New York, for the first time in 20 years. Also reported from Texas and Iowa.

Puccinia malvacearum, rust. Connecticut, usual amount; New York; New Jersey, found as early as March 13; Pennsylvania, usual amount; Wisconsin, less; Michigan, less, "Fewer inquiries about rust control than in any season for at least 10 years".

Heterodera marioni, root knot. Texas.

AMARANTHUS CAUDATUS

Pythium debaryanum, damping-off. Connecticut, "One report of seedling trouble with love-lies-bleeding, a new host to the State." This is the first report to the Survey of the organism on this host.

AMPELOPSIS

Guignardia bidwellii, black rot leaf spot. Connecticut, on A. tricuspidata, usual amount, more than last year; New York, much more than usual, especially prevalent in southeastern New York; Texas.

Septoria ampelopsidis, leaf spot. Iowa, in nurseries. First report from State.

ANCHUSA

Rhizoctonia solani, damping-off. Connecticut, "One report, a new host to State."

ANEMONE

Botrytis cinerea, gray mold. New Jersey.

Heterodera marioni, root knot. Connecticut, in greenhouse, new to State. New York, on A. sylvestris.

Mosaic (virus). California, on A. japonica.

ANTIRRHINUM MAJUS

Botrytis cinerea, gray mold. Connecticut in greenhouse, new host to State.

Oidium sp., powdery mildew. Powdery mildew does not seem to have been reported previously on snapdragon in this country. In 1936 Guba reported its occurrence in October in a greenhouse in Massachusetts, where the grower said he had observed it frequently in past years (P.D.R. 20: 303), and Kirby found a single case in a greenhouse at Boyertown, Pennsylvania, in December. The whole planting was heavily covered.

Phyllosticta antirrhini, leaf blight. West Virginia, Cabell County.

Phytophthora sp., wilt. Minnesota, "Observed only on plants growing in cloth houses in which approximately 1 percent of several thousand plants were wilting at the time of inspection. Temperature and humidity were both high. No reports on outdoor plants most of which were burned by the heat."

Phytophthora cactorum, stem rot and wilt. New Jersey, in greenhouses (P.D.R. 20: 293-294).

Puccinia antirrhini, rust. In Connecticut and New York there was the usual amount, in Massachusetts, Wisconsin, Minnesota, and North Dakota less, in Kansas it was not observed in 1936, in California more was reported. Rust also was reported from New Jersey, District of Columbia, Texas, and Washington. Reports are as follows: Massachusetts--Least seen in years. Slight loss. Minnesota--Observed only around Twin Cities. Abundant in greenhouses in spring, and scattered infections out-of-doors during latter part of May and early June. No reports late in the season; too dry and too hot. California--More than usual. All varieties immune prior to 1936 became heavily infected this year. Outbreak of rust in "rust-resistant" varieties due to appearance of a new strain of the rust pathogen. Weather is apparently rarely a limiting factor.

Sclerotinia minor, minor drop rot. Connecticut, two reports, in greenhouse.

S. sclerotiorum, stem rot. Michigan, "More than usual. Observed commonly in forcing stocks in January and February. Poor drainage and poor ventilation are contributing factors."

Verticillium albo-atrum, verticillium wilt. Massachusetts, California (autumn of 1935). (P.D.R. 20: 125-126, 302).

Deterred blossoming. Connecticut, "A physiological trouble new to State. Flowers bloom normally, stop and start to bloom again."

Mosaic (virus). Kansas, "Noted in several gardens. Plants stunted, mottled-chlorotic (near other plants affected by cucumber no. 1 virus)."

AQUILEGIA

Septoria sp., leaf spot. On A. alpina in Connecticut, "One report of considerable injury under moist conditions; trouble new to State."

Mosaic (virus). Kansas, on A. coerulea in a garden in Manhattan, first report for State.

ARBUTUS UNEDO

Septoria unedonis, leaf spot. Oregon, first report in America.

ASPARAGUS SPRENGERI

Bacterium tumefaciens, crown gall. Oregon 1933, Florida 1935. Only reports of occurrence on this host. (P.D.R. 21: 31-32).

ASTER

Bacterium tumefaciens, crown gall. Connecticut, one report on A. frikartii. This is the first report to the Survey on this host.

Coleosporium solidaginis, rust. Connecticut, on A. alpinus.

AZALEA

Exobasidium vaccinii, leaf curl. California, in Alameda, Los Angeles, and Orange Counties; Mississippi, on A. nudiflora.

Phomopsis sp., bark blight. Massachusetts.

Sporocybe azaleae, bud blight. Massachusetts, a very destructive disease, general in the State and has been found on some wild plants.
Trichothecium lignorum, Massachusetts. Has been commonly isolated and inoculations show it to be an active parasite.
Verticillium albo-atrum. Massachusetts.

BEGONIA

Armillaria mellea, mushroom root rot. San Mateo County, California, on tuberous begonia.
Botrytis cinerea, gray mold. New Jersey.
? Virus disease. Spokane and Pierce Counties, Washington.
Leaf blight, non-par. Washington.
Leaf scorch due to lack of nitrogen, followed by Botrytis. New Jersey.

BELAMCANDA

Heterosporium gracile, leaf spot. Los Angeles County, California.

BUXUS

See P.D.R. 20: 276-277 for a report on boxwood diseases in Virginia, by J. G. Harrar and S. A. Wingard. The following fungi were associated: Fusarium, Macrophoma candollei, Nectria rousselliana, Phoma, Phomopsis, Rhizoctonia, Verticillium, and Volutella buxi. Macrophoma candollei, Phyllosticta sp., and Volutella buxi were found in a survey in Massachusetts (P.D.R. 21: 57), and M. candollei and Nectria rousselliana were reported from New Jersey.

CALENDULA

Cercospora calendulae, leaf spot, was first noticed in Virginia, in 1933, and has been increasing since. It causes a severe blight of affected plants but is easily controlled. (P.D.R. 20: 277-278).
Sclerotinia sclerotiorum, drop. Texas.
Spotted wilt (virus). About 10 to 15 percent of the Masterpiece variety developed symptoms characteristic of spotted wilt in greenhouse plantings in Michigan. In California 5 percent infection was observed at Colma in November.

CALLISTEPHUS CHINENSIS

Coleosporium solidaginis, rust. Reported as severe on the varieties Freedom, Nancy, and Queen Mary, in Connecticut. Also reported from Massachusetts, New York, Wisconsin, and California.
Erysiphe polygoni, powdery mildew. New Jersey.
Fusarium conglutinans callistephi, wilt. In Pennsylvania injury from wilt was favored by low moisture and high temperatures and there was more loss than usual. In Minnesota wilt was reported only from St. Paul, where it caused 100 percent loss in Queen of the Market and occurred in varying amounts in other varieties among several thousand plants grown in cloth houses from supposedly resistant seed obtained

from a firm in Chicago and another in California. It was not reported on outdoor plants, most of which dried up during the hot weather. The disease was also reported from New York, New Jersey, Wisconsin, North Dakota, and from Tacoma, Washington.

Phomopsis callistephi, stem canker. Wisconsin, serious only in shade grown plants.

Spotted wilt (virus). California, in Alameda, San Benito, and Monterey Counties.

Yellows (virus). Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Michigan, Minnesota, Wisconsin, Kansas, Washington, and California, mostly in about the usual amounts. However, the abundance of the leafhoppers early in the summer permitted more infection than usual in Michigan. In Wisconsin, on the other hand, it was said to be so hot that the vectors were scarce and less yellows developed. In Minnesota also there was possibly less than usual, but heat injury was so severe as to overshadow everything else.

CAMELLIA

Pleospora sp., leaf spot. Washington, in Gray's Harbor County.

Sphaeropsis sp., leaf spot. New Jersey, Union County.

Leaf spot caused by physiological burning. Washington.

CAMPANULA

Coleosporium campanulae, rust. New York, on C. rapunculoides, associated with rust on Pinus sylvestris (P.D.R. 20: 358-359).

CELOSIA CRISTATA

Rhizoctonia solani, damping-off. One report in Connecticut, the first report in the Survey files on this host.

CENTRANTHUS RUBER

Ramularia centranthi, leaf spot. California.

CHENOPODIUM BONUS-HENRICUS

Stagonospora chenopodii, leaf spot. Said to be present each year on "Good King Henry" in the vegetable gardens at the New York Agricultural College.

CHRYSANTHEMUM HORTORUM

Bacterium tumefaciens, crown gall. Connecticut, Texas.

Botrytis cinerea, gray mold. New Jersey.

Cylindrosporium chrysanthemi, leaf spot. New York.

Erysiphe cichoracearum, powdery mildew. Connecticut, one report of severe injury; New York; New Jersey; Delaware, very prevalent on hardy chrysanthemums during September; Pennsylvania, occurs all year in greenhouses, of slight importance; Washington.

Fumago vagans, sooty mold. New Jersey.

*Puccinia chrysanthemi*, rust. New York, severe in several greenhouses on Long Island; Washington, in Pierce County.
*Rhizoctonia* sp., root rot. Texas.
*Septoria* sp., leaf spot. Washington, Pierce County.
*S. chrysanthemella* (*S. chrysanthemi*), leaf spot. New Jersey and Texas.
*S. obesa*, leaf spot. Destructive on Long Island in October. (P.D.R. 20: 326).
*Verticillium* sp., verticillium wilt. New Jersey, reported as *V. dahliae*. Washington, general in greenhouses.
Yellows (aster yellows virus), is infrequently found in New York. In Michigan, one instance was observed of serious loss in a greenhouse and a few diseased plants were seen in other plantings.
*Cuscuta* sp., dodder. New Jersey.
*Aphelenchoides fragariae*, leaf nematode, was severe in one Connecticut nursery on Mercury, Cavalier, and Granny Scoville varieties.

CHRYSANTHEMUM LEUCANTHEMUM

Yellows (aster yellows virus). In Kansas some pasture lands with thousands of wild daisy plants had in certain large areas 50 percent of the plants affected with this virus.

CIRSIUM ARVENSE

? *Fusarium* sp., associated with wilt, was reported from Washington. The Survey has no other report in its files of a *Fusarium* on Canada thistle.
*Puccinia obtegens*, rust. Washington.

CLARKIA ELEGANS

*Pucciniastrum pustulatum*, rust, was reported from New York, for the first time in the United States outside of Alaska, on greenhouse plants in December. (P.D.R. 21: 11).
Fasciation (undet.), was reported from Connecticut, the first time this trouble has been recorded on this host in Survey reports.

COLEUS

*Verticillium* sp., verticillium wilt. Connecticut, one report.
*Heterodera marioni*, root knot. Connecticut, new host to State, in greenhouse on *C. blumei*.

CRASSULA

*Armillaria mellea*, mushroom root rot. California, in Los Angeles County, the first report on this host to the Survey.

CYCLAMEN

*Fusarium* sp., stem rot. New Jersey, the first report on the host in the Survey files.
*Phyllosticta* sp., leaf spot. New Jersey.
*Heterodera marioni*, root knot. New Jersey.
Stunt (undet.), was said to be serious in some Los Angeles County, California, greenhouses, and also occurred in Ventura and Alameda Counties.

CYDONIA JAPONICA

Gymnosporangium clavipes, quince rust. One report in Connecticut.

DAHLIA

Armillaria mellea, mushroom root rot. California, Monterey County.

Bacterium tumefaciens, crown gall. Reported as new on dahlia in Connecticut.

Erysiphe sp., powdery mildew. New Jersey; Delaware, very prevalent during September.

Fusarium sp., rot. New Jersey.

Mosaic (virus). More than usual was reported from Wisconsin, where it seemed to be worse in dry weather. It was also reported from New York and New Jersey.

Ring spot (virus), was general in the American Dahlia Society test garden at East Lansing, Michigan, more than 100 varieties being affected.

Stunt (virus). New York and Pennsylvania.

Root desiccation in storage, due to immaturity when frosted, was reported from Seattle, Washington.

DELPHINIUM

Bacterium delphinii, black spot. Massachusetts, least observed in years; Pennsylvania, observed at only one place, at Lancaster; Michigan, not important because of dry season; Wisconsin, less than usual.

Botrytis cinerea, gray mold. Less than usual in Massachusetts and Wisconsin, also reported from New York.

Erysiphe polygoni, powdery mildew. Massachusetts, Connecticut, Pennsylvania, Virginia, Minnesota (Erysiphe sp.), and Washington. In Minnesota the disease was observed only in the eastern part of the State, where there was more than usual. Very heavy infections occurred in both watered and unwatered gardens.

Rhizoctonia solani, damping-off. Connecticut.

Sclerotium delphinii, crown rot. Connecticut, New York, New Jersey, Pennsylvania. In Pennsylvania 93 percent loss was observed in one three-acre field.

Mosaic (virus). Pennsylvania.

DIANTHUS CARYOPHYLLUS

Alternaria dianthi, branch rot. Connecticut (reported as black leaf spot), New York, Pennsylvania, Texas.

Botrytis cinerea, gray mold. Massachusetts, New Jersey.

Corticium vagum (Rhizoctonia solani), stem rot. Massachusetts, New York, Pennsylvania, Texas, Iowa, and Kansas in greenhouses only.

Fusarium sp. Wilt was reported from New York and New Jersey. Stem rot was said to be general and serious in many plantings of the very susceptible Matchless variety in Michigan, while the variety Senator was reported as resistant.

Uromyces caryophyllinus, rust. Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, California.

ECHIUM

Dematophora sp., root rot. San Mateo County, California.

ERIGERON

Yellows (aster yellows virus), was noted on wild "colt's tail" plants at a number of places in Kansas.

ERYTHRONIUM

Uromyces heterodermus, rust. Washington, in King County.

EUONYMUS

Bacterium tumefaciens, crown gall. Connecticut.
Microsphaera alni, powdery mildew. Illinois, on E. atropurpureus.

EUPATORIUM

Sclerotium delphinii, crown rot. New Jersey (P.D.R. 20: 198).

FREESIA

Bacterium marginatum, scab. Washington.
Fusarium sp., corm rot and wilt. New York.

GARDENIA

Botrytis cinerea, bud blight. Washington.
Phomopsis sp., canker and gall. New Jersey and Washington.
Phyllosticta sp., die-back. New Jersey.
Oedema, non-par. New Jersey.

GARRYA ELLIPTICA

Cercospora glomerata, leaf spot. Santa Barbara, California.

GERBERA JAMESONII

Phytophthora sp., root rot. California.

GLADIOLUS

Bacterium gummisudans, leaf spot. Wisconsin.
B. marginatum, scab. Pennsylvania, Texas, Minnesota in the Twin City region only, Wisconsin, Michigan, western Washington. In Minnesota infection was heavy on the corms of some varieties but heat injury obscured all other damage during the growing season. In Michigan the disease was more serious than usual in spite of the very dry season until September. In Wisconsin scab and corm rots, including Fusarium and Penicillium, were less abundant than usual because of dry weather although the diseases developed rapidly after rains. Early dug corms were very clean.
Fusarium sp., corm rot and wilt. Corm rot was reported from Pennsylvania (F. oxysporum), New Jersey, Texas, and Wisconsin. Wilt is rapidly becoming very serious in commercial plantings in Michigan. There was much more than usual in 1936 and some of the most susceptible varieties suffered heavy losses.

Penicillium gladioli, corm rot. Pennsylvania, Wisconsin.
Pythium sp., dry rot. Texas.
Sclerotinia gladioli, sclerotial rot. In Minnesota the disease was reported only from two localities. Excessive heat caused so much injury that it was difficult to estimate the damage due to the disease but it was probably more serious than the reports indicate, since there was so much last year. The disease was also reported from western Washington.
Septoria gladioli, hard rot. New Jersey, Pennsylvania, Wisconsin.
Mosaic (virus). Pennsylvania, California.

GYPSOPHILA
Bacterium gypsophilae, crown gall. New Jersey.
Fusarium sp., damping-off. Connecticut, one report on seedlings of G. alba.

HEDERA HELIX
Vermicularia sp., leaf spot. Washington.
Leaf blight, non-par. Washington.

HELIOTROPIUM
Heterodera marioni, root knot. Connecticut, in greenhouse, new host in State.

HESPERIS MATRONALIS
Mottle mosaic (virus). Oregon (P.D.R. 20: 199).

HIBISCUS OCULIROSEUS
Puccinia hibisciata, rust. Pennsylvania, one collection, in Berks County, July 21.

HYDRANGEA
Oidium sp., powdery mildew. Minnesota, one report of heavy infection in a greenhouse containing 500 to 600 plants.
Interveinal necrosis, caused by disturbed water relation. Washington.

IRIS
Bacillus aroideae, soft rot, was observed in serious amounts in Michigan for the first time in several years.
B. carotovorus, soft rot, followed borer injury in Massachusetts. In Wisconsin, it came late after rains. It was bad in two nurseries, but generally less than usual. Also reported from New York, Pennsylvania, and Minnesota.
Bacterium tardicrescens, bacterial blight. The drought of the latter part of May and during July and August apparently reduced injury in iris beds at Amherst, Massachusetts.
Botrytis cinerea, blossom blight, caused slight injury in Massachusetts.

B. convoluta, crown rot, was found in the same localities, in Ramsey and Dakota Counties, in Minnesota as in the last two years. It was more severe than in 1935, but less so than in 1934.

Didymellina iridis (Heterosporium gracile), leaf spot. Greatly increased prevalence in Michigan was attributed to susceptible soft growth resulting from warm weather early in the season, and very wet cool weather in May favoring infection. The disease developed very extensively in plantings where old leaves were not burned early. Leaf spot was unusually severe in western Washington also, especially on bulbous iris in the Puget Sound area. Other States reporting the disease are Massachusetts, Connecticut, New York, Texas, Wisconsin, Minnesota, Kansas, and California.

Puccinia iridis, rust, was reported as epiphytotic on Nantucket Island, Massachusetts. Susceptibility of varieties and species as observed in California was reported by M. W. Gardner as follows: "Numerous varieties are resistant. A trace occurred on Padre, Santa Barbara, Purissima, San Luis Rey, Lady Foster, Shining Water, and California Blue. Modoc and New Albion were susceptible, and Santa Fe, San Rafael, Pale Moonlight, Ivory Coast, and Plume-d-Or very susceptible. The disease was bad on I. longipetala, and present on I. microsiphon and I. douglasiana." Rust was also reported from Texas.

Sclerotium delphinii, crown rot. New Jersey.

Mosaic (virus), was observed in San Mateo County, California, on the variety Supreme.

Dying of leaves from the tips, cause unknown. In Minnesota this type of injury was very extensive throughout the season. That occurring early (in May) was attributed largely to winter injury. From much of the material wilting in middle and late season Fusarium was isolated.

LATHYRUS ODORATUS

Various diseases were reported, of which the following may be listed:

Phytomonas fascians, fasciation, was reported from Michigan, where it occurred about as usual. It is controlled by thorough soil sterilization.

Mosaic (virus). New Jersey, Kansas, and California.

Spotted wilt (virus). California.

LIGUSTRUM

? Glomerella cingulata. Canker and blight, probably due to this organism, was found in Manhattan and Abilene, Kansas, causing considerable damage to hedges.

Phomopsis sp., gall. Tennessee.

Rosellinia (Dematophora) necatrix, root rot. California, in Butte, Napa, Santa Cruz, and Monterey Counties.

LILIUM

Bacillus carotovorus, soft rot. Massachusetts.

Bacterium destructans. Soft rot of bulbs and stems attributed to this organism was reported from West Virginia.

Botrytis sp., gray mold. New York, Pennsylvania on L. candidum (Madonna lily), Wisconsin.

B. elliptica, blight, was serious in one planting of L. formosanum (Philippine lily) in Rhode Island (P.D.R. 21: 87). L. candidum and L. regale (regal lily) became seriously affected in Michigan following very heavy rainfall in September, and hybrid lilies were also heavily infected. Leaves were severely damaged in home gardens in western Washington.

Mosaic (virus), caused the failure of 3,500 bulbs of L. longiflorum giganteum, imported from Japan, in a greenhouse in San Francisco, California. It was also reported from Massachusetts, New York, and Wisconsin.

Basal stem rot, due to mixed infection. Washington.

LYCIUM HALIMIFOLIUM

Puccinia tumidipes, rust. South Dakota.

MATTHIOLA INCANA

Bacterium sp., blight, caused total loss in the seed crop of some varieties in San Benito County, California.

Mosaic (virus), occurred at Berkeley and San Pablo, California. It causes breaking of the blossoms.

MONARDA DIDYMA

Puccinia menthae, rust. Connecticut.

NARCISSUS

Botrytis polyblastis, "English fire", was unusually severe in the Puget Sound area of western Washington.

Fusarium bulbigenum, bulb rot. Washington, in Pierce County.

Stagonospora curtisii, leaf scorch, also was severe in the Puget Sound region of Washington.

Ditylenchus dipsaci (Anguillulina dipsaci), bulb nematode, was reported from Michigan as ruining a planting of daffodils for winter forcing. The bulbs were grown in Washington.

Mosaic (virus). California.

NERIUM OLEANDER

Bacterium tonellianum, bacterial gall. Connecticut, the first report of its occurrence in the State.

PACHYSANDRA

Volutella pachysandrae, blight, was observed to be very serious in one planting in New Jersey.

PAEONIA

Botrytis paeoniae, blight. New York, New Jersey, Wisconsin, Minnesota, Washington.

Cercospora variicolor, leaf spot. Iowa, light infection in nurseries.
Cladosporium paeoniae, leaf blight. New York, Michigan, Wisconsin. In Michigan the disease was observed in extremely serious form in one twenty-acre planting. The plants were dwarfed and were practically defoliated in some varieties.
Coniothyrium sp., causing wilting and killing of flower stems of tree peony (P. moutan) in California (P.D.R. 20: 236-238). Probably identical with C. fuckelii.
Phytophthora sp., blight. Minnesota.
Sclerotinia sclerotiorum, stem rot. New York.
Septoria paeoniae berolinensis, leaf spot, was reported as much less prevalent than in 1935 when it was first observed in variety test plots at East Lansing, Michigan. The disease was also reported from Oregon for the first time, although the specimen had been collected in 1914. (P.D.R. 20: 89).
Hot weather injury was reported from Kansas. The plants died down early after blooming. New buds formed on the crown as they do in the fall when the plant normally becomes dormant. Plants in both irrigated and non-irrigated fields behaved similarly, so it would seem that the trouble was not due to a soil moisture relation.

PANDANUS

Diplodia natalensis, causing death of plants of P. javanicus variegatus, was reported from Alabama, the first record on this host in the Survey files. (P.D.R. 20: 238).

PASSIFLORA

Sclerotinia sp., causing collar rot. California.

PELARGONIUM

Bacterium erodii, bacterial leaf spot. Connecticut.
Botrytis sp., tip blight. Washington.
Mosaic (virus), Washington.

PENTSTEMON

Puccinia andropogonis pentstemonis, rust. Connecticut, in nursery, new to the State on cultivated P. unilateralis x torreyi and P. acuminatus.

PETUNIA

Fusarium sp., wilt. Washington, Whitman County.
Oidium sp., powdery mildew. West Virginia. This seems to be a rare disease on petunia, only one other record being known for the United States, from New York in 1930.
Cuscuta sp., dodder. Texas.
Yellows (aster yellows virus). In Michigan typical symptoms of aster yellows were observed in one variety in September.

PHILADELPHUS

Septoria philadelphi, leaf spot. In nurseries in Iowa.

PHLOX

Erysiphe cichoracearum, powdery mildew. In Minnesota the disease was observed only in Ramsey County, where heavy infection occurred in many gardens late in the season. The variety Columbia was said to be susceptible. Powdery mildew reported as this species occurred also in New Hampshire, Connecticut, New York, New Jersey, Virginia, and Illinois.

Oidium sp., powdery mildew. New York, in growing point of young flower heads, in leaves and blossoms. Delaware, very prevalent during September. Texas.

Pyrenochaeta phloxidis, stem blight. New York.

Septoria divaricata, leaf spot. New York.

Sphaerotheca humuli, powdery mildew. New York.

Wilt, cause unknown. Washington.

PIQUERIA (Stevia)

Yellows. Michigan, plants in greenhouse showed typical symptoms of aster yellows virus in November. Identity not proved by inoculation.

POINSETTIA

Sclerotinia sp., stem rot. Washington, in Puget Sound area.

? Virus disease. Washington.

PRIMULA

Botrytis sp., leaf blight. Washington.

Phytomonas primulae, bacterial spot. California.

RANUNCULUS

Botrytis sp., blight. California.

RESEDA ODORATA

Rhizoctonia solani, damping-off. Connecticut.

RHODODENDRON

Alternaria sp., damping-off. Connecticut, reported once on seedlings of R. catawbiense.

Botrytis sp., Seedling blight was reported from New Jersey; twig blight from Washington.

Chrysomyxa piperiana, rust. Washington.

Ramularia sp., leaf spot. California.

Rhizoctonia solani, damping-off. Connecticut, on R. catawbiense.

ROSA

Bacterium tumefaciens, crown gall. Massachusetts, New Jersey, Pennsylvania, Texas, Wisconsin, Kansas, Washington, California.

Botrytis sp. Bud blight was reported from New Jersey (B. cinerea), and Texas. Foliage and stem injury occurred in California.

Diplocarpon rosae, black spot, was widely reported, as usual. In Michigan it was said to be much less prevalent in forcing houses than formerly due to the use of Selocide for the control of red spider. On garden plants it developed late but caused defoliation in September.

SAINTPAULIA

Botrytis sp., botrytis rot. New York, may be severe on African violet in poorly managed greenhouses.

SCABIOSA

Yellows (California aster yellows virus). California, at Colma, San Mateo County.

SEDUM

Sclerotium delphinii, crown rot. New Jersey.

SPIRAEA

Cylindrosporium filipendulae, leaf spot. Iowa, on young stock in nurseries.

SYRINGA

Bacterium syringae, bacterial blight, was not seen in the usual locations in Massachusetts. In Michigan there was much more than usual. Infection was general in one nursery specializing in lilacs. It was severe in young grafted plants, killing as many as 20 percent of the grafts of some varieties. The disease was also reported from Connecticut.

Botrytis cinerea, leaf spot and blossom blight. New Jersey.

Gloeosporium sp., leaf and shoot blight. Massachusetts.

Microsphaera alni, powdery mildew. See the Reporter, 21: 134-138, for a note on the relative susceptibility of lilacs to powdery mildew, by Ivan H. Crowell. The disease was widely reported, as usual.

Phoma sp., leaf spot. Wisconsin.

Phyllosticta syringae, leaf spot. Washington.

Graft blight caused by graft incompatibility. Observed in Massachusetts but caused little injury.

TAGETES

Botrytis sp., blight. New Jersey.

Fusarium conglutinans, wilt. California, Los Angeles County.

TROPAEOLUM MAJUS

Spotted wilt (virus). California.

TULIPA

Botrytis tulipae, fire. Connecticut, New York, New Jersey, Pennsylvania, Michigan, Wisconsin, Washington.

"Petalinus leaf", non-parasitic. Connecticut, one report of petals turned half leaf.

VIOLA

Cercospora violae, leaf spot. On pansy, V. tricolor, in Connecticut, bad in the one case reported.

Colletotrichum violae-tricoloris, anthracnose. On pansy in Connecticut, one report on old plants. On Viola sp. in Texas.

Phyllosticta sp., leaf spot. California.

Puccinia violae, rust. New Hampshire, Connecticut.

Rhizoctonia sp., root rot. Minnesota, in Twin Cities region on pansy.

Sclerotium delphinii, stem rot. California.

Sphaceloma violae, scab. Pennsylvania.

YUCCA

Coniothyrium concentricum, leaf spot. Connecticut, one report, fungus new to State.

ZANTEDESCHIA

Phytophthora sp., bud rot. Washington.

Spotted wilt (virus). California.

ZINNIA

Alternaria sp., damping-off. Reported once in Connecticut, on seedlings.

Cercospora atricincta, leaf spot. Texas.

Erysiphe cichoracearum, powdery mildew. Delaware, Virginia, Texas, Minnesota, North Dakota, Kansas.

Rhizoctonia bataticola, charcoal rot. Texas.

R. solani, root rot. Texas.

Sclerotinia sclerotiorum, stem rot. California, ruined greenhouse crop at Colma.

Curly top (virus). Idaho (P.D.R. 21: 54).

Mosaic (virus). Kansas.

Spotted wilt (virus). California.

Yellows (aster yellows virus), was observed in Michigan for the first time in September. Asters nearby were ruined by yellows.

# INDEX OF ORGANISMS AND NON-PARASITIC DISEASES

in

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E



F

14