THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
AGRICULTURAL RESEARCH ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE

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CANTALOUPE MOSAIC INVESTIGATIONS IN THE IMPERIAL VALLEY

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Plant Industry Station Beltsville, Maryland

CANTALOUPE MOSAIC INVESTIGATIONS IN THE IMPERIAL VALLEY

Plant Disease Reporter
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FOREWORD

The University of California and the U. S. Department of Agriculture, in cooperation with the Cantaloupe Pest Control Committee of the Imperial Valley, have undertaken a joint project designed to investigate all phases of the cantaloupe mosaic disease. This disease has caused damaging losses to the cantaloupe growers of the Imperial Valley during the past three years and threatens to become a major disease in other producing areas of the Southwest. The results of preliminary investigations by staff members assigned to the project are reported in this Supplement. These reports were presented at a meeting of the Imperial Valley Cantaloupe Pest Control Committee, in Brawley, California, June 16, 1948.

CONTENTS

THE CANTALOUPE MOSAIC DISEASE

John T. Middleton

Cantaloupe mosaic is a virus disease affecting most cultivated melon varieties as well as some other cultivated cucurbits. The disease may be caused by any one of a number of strains of cucumber viruses within the families Cucumber 1 and Cucumber 2. As yet it is not possible to determine exactly which virus is most prevalent, but it would appear that the squash mosaic virus is predominant.

The most conspicuous symptoms of the disease are the light green and dark green mottling of the leaves, usually followed by leaf reduction, a mottling of fruits, and the failure of most melon varieties to set fruit or mature them in normal fashion.

Information concerning the host range of the virus is limited, but apparently a number of native plants are reservoirs for the virus. The cantaloupe mosaic virus is known to occur in Cucurbita foetidissima H.B.K. and C. palmata Wats., both native to the Colorado Desert. In addition to the native flora, the virus is found commonly in squash, and it is believed that squash is the prime source of the virus for the cantaloupe mosaic disease. The virus may be spread mechanically, may be transmitted by the seeds of certain plants, and is generally distributed by means of insect vectors. At present it is known that two species of cucumber beetles [Diabrotica undecimpunctata Mann. and Acalymma trivittata (Mann.)] and three species of aphids [Aphis gossypii Glov., Macrosiphum pisi (Kalt.), and Myzus persicae (Sulz.)] are vectors. Control of the disease is based on the elimination of the virus or the vectors, or the production of resistant varieties.

Although disease-free seed can be produced and has been generally used, the planting of virus-free seed is not the solution of the problem; but is an important aspect to be considered. The abundant sources of virus in squash, melon, and other cultivated cucurbits, as well as the native sources of the virus, make it impossible to have host-free periods which would effectively control melon mosaic.

During the past melon season (1947-48), through the cooperation of the University of California, Division of Entomology, Riverside, extensive trials were conducted, which were directed towards the control of the insect vectors. Repeated applications of insecticides at appropriate times to melons failed to reduce the amount of mosaic in melons. The principal source of the aphids appears to be the sugar beet. The sugar beet does not provide much, if any, virus inoculum. The increased occurrence of melon mosaic in Imperial Valley may possibly be correlated with the present increase in sugar beet acreage.

There is considerable evidence that fairly satisfactory yields of melons may be obtained despite the presence of the virus, if the crop is carefully handled as to irrigation and fertilization. Plantings 100 percent infected were noted that gave satisfactory yields. It was determined that these fields received more frequent irrigations than similar adjacent fields which yielded poorly, and that the better yielding fields had received small but regular applications of nitrogen.

Vector control is not recommended. In the absence of any satisfactory resistant melon variety, it is felt that fair crop yields may be expected if attention is focused upon proper horticultural practices for the best growth of cantaloupes.

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VECTORS CONCERNED IN TRANSMISSION OF CANTALOUPE MOSAIC IN THE IMPERIAL VALLEY

J. E. Swift

The purpose of this study is to determine specifically which aphids and cucumber beetles are the transmitting agents for the cantaloupe mosaic virus complex. It was also hoped that through vector transmission studies sources of the viruses could be determined.

Aphids and cucumber beetles were secured from various weeds and crops, and also free-flying ones in the air. These insects were then placed on disease-free squash or melon plants grown in a greenhouse designed to prevent any possible outside or chance infection.

Five cucumber beetles (four *Acalymma trivittata* (Mann.) and one *Diabrotica undecimpunctata* Mann.) were collected; all failed to transmit the virus in this test.

Aphids used in this study were collected from alfalfa, bamboo or cane, barley, sourclover, lambsquarters, malva, healthy-appearing melons, infected melons, sowthistle, infected squash, sugar beet, sunflower, and wild beet; also free-flying insects were used, including those caught in the air and placed on diseased plants before caging and those caught in the air and caged upon a healthy plant immediately. The plants mentioned above were selected because they maintained large aphid populations and thereby became suspects as possible hosts for the viruses.

The green peach aphid, *Myzus persicae* (Sulz.), comprised 61.8 percent of the aphids used as possible vectors. The pea aphid, *Macrosiphum pisi* (Kalt.), and potato aphid, *M. solanifolii* (Ashm.), constituted 16.3 percent of the total number. Representatives of other species were used in much smaller numbers.

From 11,643 aphids used in making 187 inoculations 10 positive transmissions resulted. Only the green peach aphid and the melon aphid, *Aphis gossypii* Glov., transmitted the virus. The melon aphid accounted for two of the transmissions. Both of these were effected by collecting apterous melon aphids from infected squash plants and placing them on healthy melon plants. Eight transmissions were made by the green peach aphid. Six of these transfers were by winged aphids, the other two by both winged and apterous aphids in the same culture. In these eight transmissions by the green peach aphid, three were accounted for by utilizing either winged or apterous aphids collected from infected squash or melons; three transmissions were obtained by collecting free-flying aphids and then feeding them on infected squash before caging them on healthy melon plants; two transmissions were secured by collecting free-flying aphids and placing them directly on healthy melon plants.

No transmissions were effected when fewer than 15 aphids were used per inoculation. It seems possible that several feedings by viruliferous aphids are necessary before the virus is transmitted and symptoms appear. This hypothesis gains support from information available on aphid populations in the Imperial Valley and their feeding habits.

No virus transmissions were secured from plants other than infected squash or melons. Although the sugar beet is a known host for the cucumber mosaic virus and numerous tests were made using a few to several hundred aphids from sugar beet plants, no virus infections on melons resulted. Likewise, melons remained virus-free following transfers of aphids from alfalfa, bamboo, barley, wild beet, sourclover, sunflower, and sowthistle.

In summary it may be stated that: The green peach and melon aphids present in the Imperial Valley can transmit the cantaloupe mosaic virus. The green peach aphid was by far the most common species and brought about the greatest number of virus transmissions to melon. Transmissions of the virus were obtained only with aphids collected or fed upon infected squash or melons and with free-flying aphids collected in flight. No transmissions were effected with aphids taken from alfalfa, bamboo, barley, sugar beet, wild beet, sourclover, lambsquarters, malva, or weeds in general.

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VECTORS OF CANTALOUPE MOSAIC AND THEIR TRANSMISSION HABITS

J. B. Kendrick, Jr.

Preliminary work has been directed towards establishing the identity of vectors and their requirements for the spread of the virus or viruses that cause cantaloupe mosaic. It has been shown conclusively this year that the melon aphid and the green peach aphid, Aphis gossypii Glov. and Myzus persicae (Sulz.), respectively, are vectors of this disease when used in populations of fifteen or more. Although Myzus persicae appears to be the principal vector, evidence indicates that other aphid species are concerned. It is the purpose of this investigation to test the numerous aphid species common in the Colorado Desert for their ability to act as vectors for this disease, and to ascertain their transmission habits for each of the viruses within the complex.

Winged, apterous, and nymph forms of the green peach aphid, Myzus persicae, corn aphid, Aphis maidis Fitch, and the pea aphid, Macrosiphum pisi (Kalt.), have been studied in the following manner. Cultures of non-viruliferous aphids have been made viruliferous by feeding once on a Honeydew plant, Cucumis melo L., infected with one of the viruses of the cantaloupe mosaic complex. They were then transferred to healthy susceptible cantaloupe seedlings, Cucumis melo L. var. cantalupensis Naud., in such a manner as to show whether one aphid feeding once could transmit the disease, and whether it could infect four healthy plants on four successive feedings. Preliminary evidence indicates that more than one aphid is necessary for such infection. The same procedure was followed with two aphids feeding once on one plant, three aphids feeding once, and four aphids feeding once. They were transferred again so that two, three, and four aphids, respectively, had their second feedings on a healthy plant, third feedings on another healthy plant, and fourth on still another healthy plant. In these trials the winged, apterous, and nymph forms of the corn aphid, the pea aphid, and the green peach aphid showed no ability to transmit the virus in such limited numbers. Thus, at least four aphids from these species having fed once on an infected host are apparently not able to transmit this virus. This study is being carried forward to find out the minimum requirements for transmission.

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APHID FLIGHTS IN RELATION TO CANTALOUPE MOSAIC

R. C. Dickson

The increased severity of cantaloupe mosaic infection in the Imperial Valley in recent years is apparently related to an increase in the spring aphid population. This increased aphid population coincided with:

1. A general increase in the severity of aphid infestations over the United States, which is believed to have been caused by the widespread use of the new synthetic organic insecticides, particularly DDT and benzene hexachloride.

2. The increase in sugar beet acreage in the Valley.

Small aphid flights began shortly before March 1. These were mostly of the corn aphid, Aphis maidis Fitch, from barley, and probably had no effect on the melons, which were still covered with cap protectors at that time. The green peach aphid, Myzus persicae (Sulz.), soon became the most numerous species and the flights increased steadily in severity. The green peach aphid breeds on lettuce, beets, and various weeds, particularly Malva and Chenopodium.

Catches on nine sets of sticky-board traps in the Valley rose from 2,000 the first week of March to 28,000 the first week of April, the percentage of green peach aphids rising from 50 to 90. The catch then dropped off, again reaching 2,000 during the last week of April.

During the height of the flights, 90 percent of the aphids flying were the green peach aphid and possibly 90 percent of these came from the sugar beet fields. The melon aphid, Aphis gossypii Glov., population was very low at this time, some 20 other species being more numerous.

Sticky-board traps in the desert caught comparatively few aphids, which shows that the aphids in the Valley originated in the Valley and probably did not travel in large numbers for more than five or six miles.

During winds the aphids do not fly, winged aphids remaining on the plants until the wind dies down. After the wind has abated and conditions become right, they take off in swarms and move across the country. Flight appears to be at random, and the insects are carried by the air drift which usually amounts to one to two miles per hour.

Attempts to measure the size of aphid flights gave figures for a good flight of some 40,000,000 aphids passing a mile front each hour.

Records of aphid activity during flights showed that when aphids landed they started to feed almost immediately, fed for an average of some 40 seconds in one to three feeding periods, then walked to the tip of a leaf and took off. They apparently flew a short distance, again landed, and repeated the feeding performance. In this way they worked themselves across the country, each aphid feeding for short periods on a considerable number of plants. Some 50 aphids per minute per melon hill were observed to light during a good flight. The same number left the hill during the same period so that there never was a great concentration of aphids on the plants. The winged aphids that are seen resting on melon plants when no flight is on are simply those that were caught there when conditions became unfavorable for flight, because of wind, darkness, or change of temperature. It is probable that if the green peach aphid preferred to feed on melon plants it would be less migratory and hence not so efficient in spreading the mosaic.

There are practically no sugar beets in the Blythe and Yuma areas. Considerable melon mosaic occurs in these areas in certain years, but less than in the Imperial Valley. Limited observations made in these two localities indicated that the green peach aphid was the most common species, but it did not occur in anything like the numbers found in the Imperial Valley. It was found breeding in good numbers on lettuce (early in the season) and on _Malva_ and _Chenopodium_. Aphids appeared to be a bit more common at Yuma than at Blythe.

Small-scale experiments were conducted in dusting cantaloupe plants with various chemicals to see if they acted as repellents. Various aromatic compounds and essential oils were used as were certain compounds known to be repellent to other insects. While at least one of these, tetramethyl thiuramdisulfide, showed some measure of repellency, none were effective in reducing the mosaic infection in the plots. All plots were 100 percent infected with mosaic.

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LARGE-SCALE INSECTICIDE TESTS

L. D. Anderson

The report on repellents shows that some of the materials tested as repellents had some effect on the aphids but did not reduce the amount of cantaloupe mosaic. The same story was found to be true in the large-scale insecticide tests.

Tests were made on the S. A. Gerrard ranch north of Westmoreland, on the American Fruit Growers ranch west of Brawley, and on the Fred. R. Bright ranch in the Mount Signal district. All insecticide applications were made by airplane, a Piper Club being used for the first application on the Gerrard ranch and the third application on the Bright ranch, and a Stearman plane for all other applications. Three applications were made on each ranch; the interval between applications varied from 8 to 13 days depending on weather conditions. The first applications were made as soon as possible after the cap protectors were removed from the cantaloupes. Each insecticide was applied to 10-acre blocks on each ranch. The plane made from 8 to 14, with an average of 10, passes to cover each plot each time. The plane flew at an altitude of 8 to 14 feet above the vines. All applications were made under fairly good weather conditions, and in the evening, except the second and third applications on the Gerrard ranch which were made in the morning. Heavy aphid flights occurred during the first and second applications on the Gerrard and the American Fruit Growers ranches and the second application on the Bright ranch. A light flight occurred while the first application was being made on the Bright ranch; slight to no flights occurred while the third application was being made on each ranch.

The insecticide dust mixtures used were the following:

- DDT 1% plus Velsicol AR60 2% (40 pounds per acre)
- DDT 5% (30 pounds per acre)
- Benzene hexachloride (1% gamma isomer) (20 pounds per acre)
- Nicotine 4% (30 pounds per acre)
- Parathion 1% (30 pounds per acre; used only on Gerrard ranch).

The third application of benzene hexachloride was omitted on the Gerrard and the American Fruit Growers ranches because of foliage injury by this material.

None of the insecticides tested appeared to affect the aphids even when the materials were being applied during heavy flights, and none of the treatments reduced the mosaic infection.

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BREEDING MUSKMELONS FOR RESISTANCE TO MOSAIC

G. W. Bohn[1]

The United States Department of Agriculture, the University of California, and the Cantaloupe Pest Control Committee of California have jointly attacked the problem of breeding muskmelons for resistance to the more important mosaic diseases. There is no good, mosaic-resistant muskmelon ready for release. Some progress has been made, however, and it seems worthwhile to summarize the breeding problem at this time.

A brief summary of the development of powdery mildew-resistant cantaloupes may serve as a basis for comparison. It took a relatively short time, ten years, to develop Powdery Mildew Resistant Cantaloupe No. 45. This variety, introduced in 1936, has a single, dominant genetic factor for resistance to strain 1 of Erysiphe cichoracearum DC., the fungus that causes muskmelon powdery mildew. The breeding work was, therefore, relatively simple.

Considerably longer, 16, 18, and 18 years, respectively, was required to develop Powdery Mildew Resistant Cantaloupes No. 5, No. 6, and No. 7. These varieties have several genetic factors for resistance to powdery mildew as well as numerous genetic factors governing yield, size, shape, quality, and the other factors that are essential to make a good commercial cantaloupe. Thus the breeding program became more complicated, and the time required to combine all of the essential characters into a single line was, therefore, longer.

Lines of cantaloupes with powdery mildew resistance more potent than that possessed by No. 5, No. 6, and No. 7 are in existence. These lines have greater numbers of factors governing resistance than the varieties mentioned and have, therefore, required a longer time for development. Several of these lines are now ready for release, so far as powdery mildew is concerned, after about 25 years of diligent work. However, mosaic has complicated the problem. Releases will be made when there is reason to believe that any line is better than those that are already on the market.

The mosaic resistance breeding program is about at the stage at which the powdery mildew breeding program was in 1927 or 1928. In the case of cantaloupe mosaic there is more than one disease; certainly two, possibly several. It is of paramount importance that these should be separated. In addition to obtaining resistance to virus diseases, powdery

[1]The opportunity is taken here to acknowledge the assistance of Mr. A. H. Hovley, agent, U. S. Department of Agriculture, who was in charge of the cultural operations, and of Mr. C. A. Sanderson, scientific aid, who prepared the photographs.

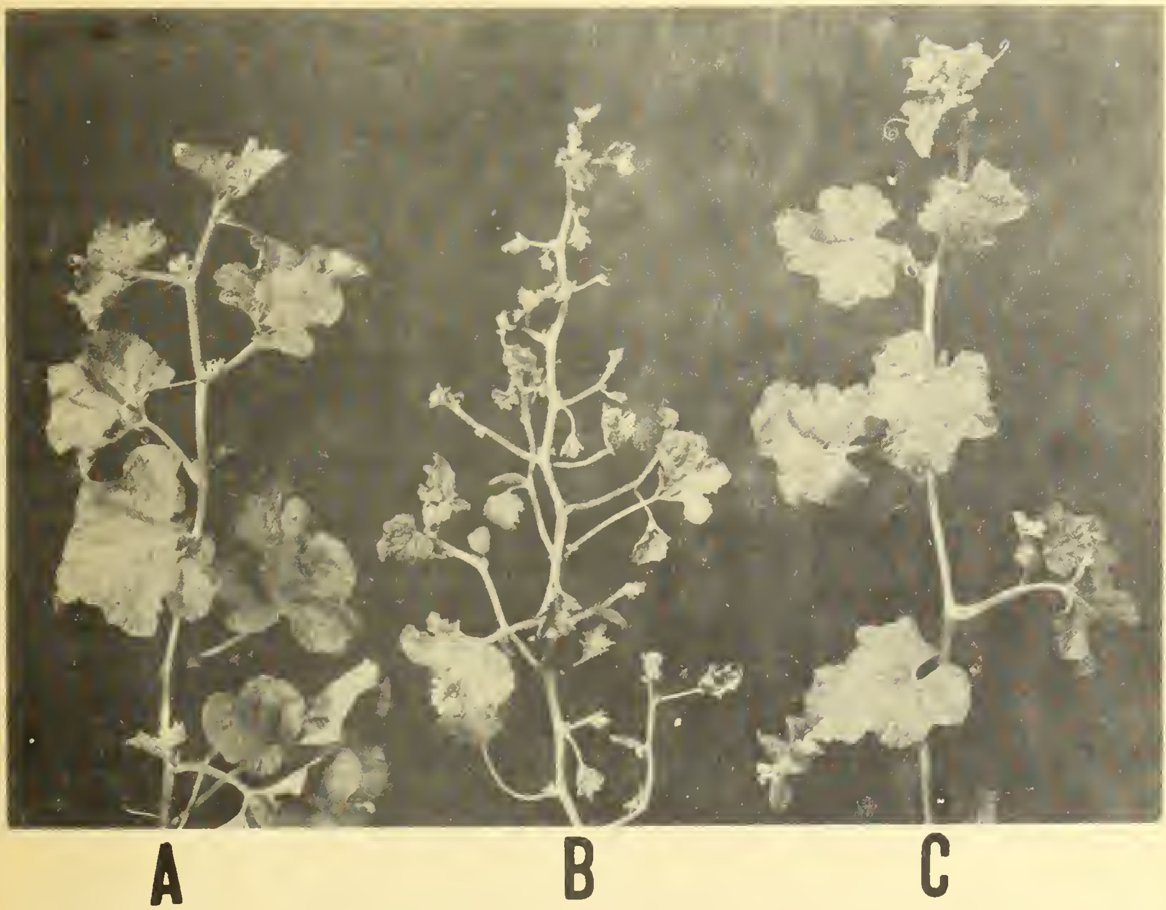

Figure 1. Shoots of muskmelons naturally infected with virus in the Imperial Valley, 1948. A — Mildly affected shoot of Cucumis melo var. chito P.I. 157076. B — Severely affected shoot of C. melo var. reticulatus commercial variety Seed Breeders' Hales Best. C — Moderately affected shoot of the commercial variety Ferry Morse's Sulfur Resistant V-1.

mildew resistance must be maintained as well as all of the other characters that are required to make a suitable commercial muskmelon.

The several distinct types of reaction of the muskmelon to the virus that might be utilized in a breeding program are: (1) Immunity -- the ability of the plant to prevent the virus from becoming established; (2) True resistance -- the ability of the plant to combat the virus and reduce its activity or abundance or both; (3) Tolerance -- the ability of the plant to tolerate the virus and to thrive although the development of the virus is also abundant; (4) Klendusity -- the ability of the plant to escape infection by the virus although it is very susceptible to the disease if infection does occur.

Of the four types of response, immunity is to be preferred. Immunity to muskmelon viruses has not been found in Cucumis melo. However, large numbers of importations from foreign countries are still being tested.

Klendusity probably has little value because of the overwhelming population of insect vectors. The nature of the aphids' habits and their abundance during migration make it very unlikely that any kind of muskmelon plant, dusted or not dusted, will have much chance to escape infection.

Resistance and tolerance remain to be considered. These are not so desirable as immunity or complete prevention of the disease by other methods; however, they are valuable. The value of resistance is demonstrated by the success of Powdery Mildew Resistant Cantaloupes No. 45, No. 5, No. 6, and No. 7 in controlling powdery mildew. The value of tolerance has been observed by most muskmelon growers who have suffered losses from mosaic. In general, cantaloupes are more tolerant than Honeydews and Honeyballs and mosaic losses have been less severe in No. 45, No. 5, No. 6, and Ferry-Morse's Sulfur Resistant V-1 than in Honeydews and Honeyballs. Similarly, Ferry-Morse's Sulfur Resistant V-1 is slightly more tolerant than No. 5 or No. 6, but it is probably not so tolerant of heat and is susceptible to powdery mildew.

The difference between true resistance and tolerance is an important one, both theoretically and practically for use in disease control. However, resistance grades into tolerance and it is often difficult to distinguish one from the other. In plant breeding both are usually measured by the intensity of symptoms developed in the host plant. To avoid confusion, the word tolerance will be used to describe the plant material on hand until resistance is proven. It should be understood, however, that there is no proof, at present, to establish whether these plants are truly resistant or merely tolerant.

Conditions were excellent for a natural epiphytotic of cantaloupe mosaic in the experimental plots near Brawley, California, in 1947 and 1948. No plant in the 5-acre planting escaped infection in either year. In any one plant the symptoms increased to a maximum, then usually subsided. Some plants showed very extreme symptoms and did not recover; some plants recovered slightly; still others developed relatively mild symptoms and exhibited marked ability to recover. Plants that showed the mildest symptoms when symptoms were at their maximum severity and showed the greatest degree of recovery were considered to have possible value in the breeding program.

All of the plants in an inbred line or in a variety or a foreign plant introduction usually showed the same intensity of symptoms and the same degree of recovery. The range in intensity of symptoms in cantaloupes is shown in Fig. 1, A, B, and C. Seed Breeders' Hales Best, Fig. 1, B, developed extreme symptoms with severe leaf mottling and distortion and suppression of leaf growth. The suppression of leaf growth without a corresponding suppression of stem growth and flower bud initiation produced the prominent symptom of leafless ("shoestring") shoots. The flowers on such plants were usually dwarfed and malformed, and frequently failed to develop fully. Those that did develop usually produced poor pollen, and the perfect or the pistillate flowers often failed to set fruits following controlled or natural pollination. Fruits that did develop were small, malformed, mosaic-mottled, and produced poor net; they were low in quality and often sunscalded. The plants showed very little ability to recover.

Ferry-Morse's Sulfur Resistant V-1 produced some shoots with severely stunted leaves, but the symptoms were often limited to moderate chlorosis and mild distortion of leaf margins, Fig. 1, C. The flowers on such plants usually matured but were occasionally malformed in some degree. The perfect and pistillate flowers set fruits fairly readily following self-pollination and set nearly normal crops of fruits following natural pollination. Such plants recovered from extreme symptom expression rapidly and grew with considerable vigor. Late symptoms were usually limited to mild mosaic chlorosis of leaves and young fruits. The fruits were usually nearly normal in size, shape, net, flavor, and soluble solids.

A few collections of the lemon cucumber (<u>Cucumis melo</u> var. <u>chito</u> Morr., P.I.[1] 148647, 157076, and 157079 to 157085 inclusive) seemed to be slightly more tolerant than any of the commercial varieties. Other collections of this variety, including one purchased on the market, were less tolerant. Symptoms in these plants were usually limited to mild or moderate mottling of the leaves, Fig. 1, A. The leaves were rarely stunted or malformed and the fruits, which are normally nonnetted, were apparently

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[1] P.I is used herein to indicate plant introductions imported through the Division of Plant Exploration or its precursors.

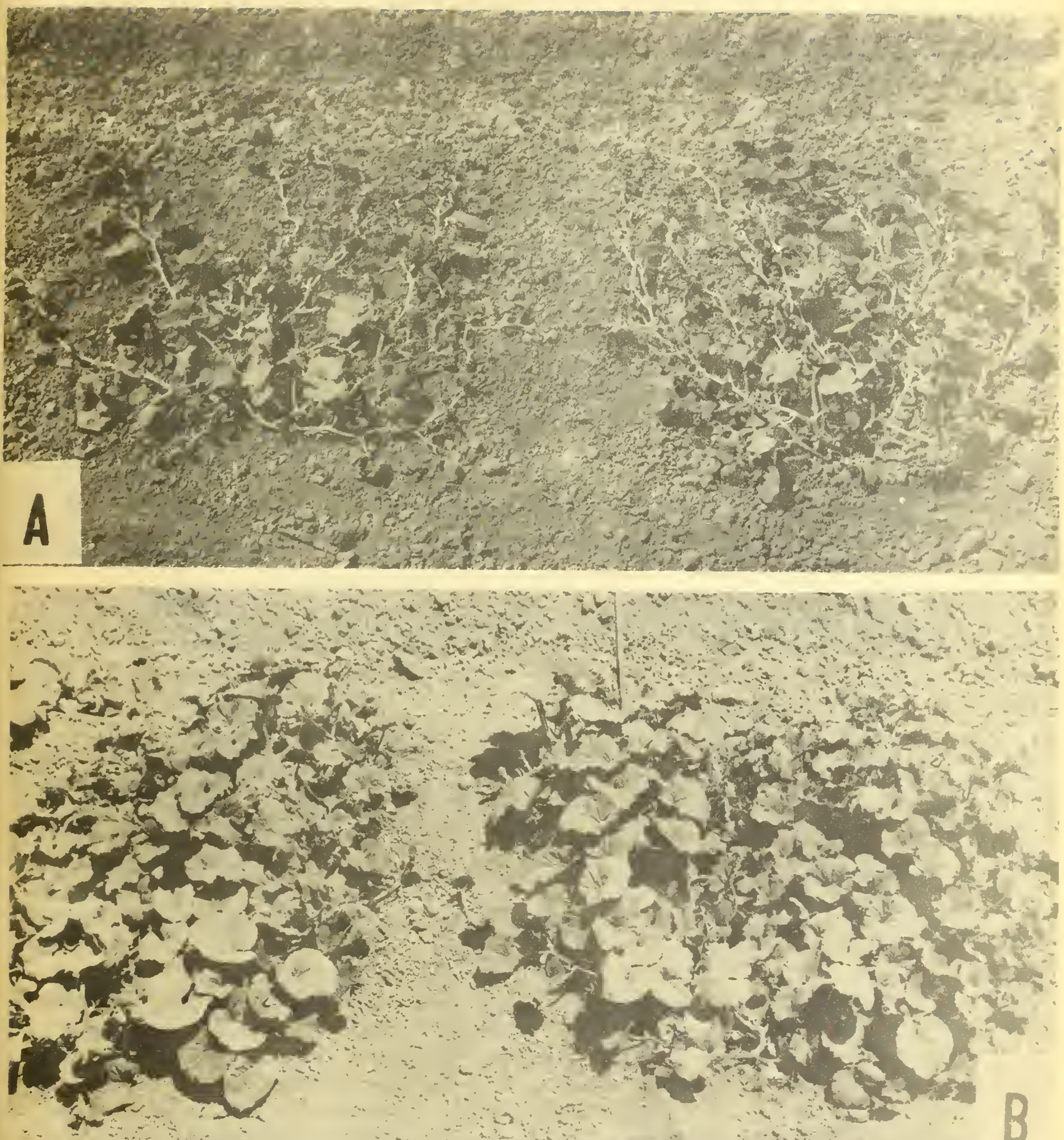

Figure 2. Muskmelon plants naturally infected with virus in the field, Brawley, California, 1948. A -- Four severely affected plants in two hills of the commercial variety Melogold. B -- Four mildly affected plants in two hills of an inbred powdery mildew resistant line similar to Melogold.

Figure 3. A severely affected plant and a mildly affected plant in a single hill of the French variety Charentais.

normal.

Most of the commercial varieties and powdery mildew resistant lines were similar to Seed Breeders' Hales Best, Fig. 1, B, or Ferry Morse's Sulfur Resistant V-1, Fig. 1, C. A few were similar to the resistant collections of Cucumis melo var. chito, Fig. 1, A. One of these, similar to the variety Melogold in fruit characters, is compared with that variety in Figure 2, A and B.

In addition to differences between lines, differences were occasionally noted within lines. A mildly affected plant and a severely affected plant in a single hill of the French variety Charentais are shown in Fig. 3. Similar differences among plants within a line occurred in material inoculated in the seedling stage in the greenhouse at the Torrey Pines Station.

The variation in reaction to mosaic among different lines and among plants within lines may have been caused by differences in the plants, in the virus or viruses, or in some other condition. Work has been initiated to determine the nature of this variation. If it is genetic tolerance it will be utilized in the breeding program. If we can combine tolerance from several different sources it is possible that we can produce a good, mosaic-tolerant muskmelon variety.

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SUGGESTIONS FOR FUTURE RESEARCH

Thomas W. Whitaker

In the light of the new information presented in the previous reports it seems that there are at least three fields of research that can be profitably explored in the future. These fall naturally into separate categories.

1. Entomological approach. Is it possible to do something about controlling aphids in sugar beet fields, that will prevent the terrific "build-up" and, later on, the infecting flight through the cantaloupe fields? In order to produce this information, some large-scale experimentation will surely be required. It will involve careful planning by the entomologists and plant pathologists, combined with the cooperation of the sugar beet and cantaloupe growers. In any event the results should be worth while if they do nothing more than indicate that some control of the aphid population can be established by appropriate treatment of sugar beet fields.

2. Horticultural. The second category, which for lack of a better term may be called the horticultural, is much in need of investigation. For example, there is the question of soil moisture; is it advisable, after infection, to stabilize the soil moisture content at a high or a low level? Apparently there is no precise or reliable information at hand to answer this question, and the chances are good that it would be exceedingly helpful if we did know about this important factor.

Likewise the effects of various fertilization practices upon symptoms of the disease have not been investigated. It is not unlikely that the severity of the disease can be alleviated to a certain extent by some variation in the kind and quantity of the nutrient supply.

3. Plant breeding. The work reported by G. W. Bohn points very strongly to the possibility that resistance to the disease is heritable. There are several indications here and there among the breeding stocks and in some of the recent accessions that indicate such may be the case. It appears to be worth while to attempt to combine the resistance exhibited by various lines into a single group of progenies. It is not unlikely that if this could be done and the characters for resistance later incorporated into commercially acceptable types, satisfactory crops of good quality could be produced. This program would evidently require several years' work to bring it to fruition, and even then there is no definite assurance it would be successful.

There is one phase of the plant breeding approach that is perhaps not being pursued with as much vigor as its importance deserves -- the plant exploration angle. It would be worth many thousands of dollars to the industry if a gene or genes carrying resistance or immunity to the mosaic disease could be imported into this country. If such material could be secured, the synthesis of a good commercial melon would be a relatively simple job. At the moment the Division of Plant Exploration and Introduction, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, has a plant explorer in the field in India; but India is a large territory for one man to cover during a limited collecting season. It is possible that much more could be accomplished by concentrated collecting in the most promising localities.

There is one category that seems to have been omitted for the moment, and that is the pathological. It is very important to know what virus or what strains of a particular virus are responsible for the damage caused by this disease. Up to the present our knowledge regarding this point is incomplete. Middleton and his co-workers have initiated a series of studies designed to provide this information. The results of this investigation will obviously be of immense importance to the plant breeding program.

One cannot help being impressed by the fact that the solution of a complex problem such as we have under consideration can only be reached by the combined efforts of a group of specialists. It is not a problem that can be solved individually by the pathologist, the entomologist, the horticulturist, or the plant breeder. However, by an intelligent fusing of the information acquired by these various specialists there is hope that some relief may be expected.

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NATION-WIDE RESULTS WITH FUNGICIDES IN 1948
FOURTH ANNUAL REPORT

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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NATION-WIDE RESULTS WITH FUNGICIDES IN 1948
FOURTH ANNUAL REPORT

Compiled by
The Fungicide Committee of the American Phytopathological Society:
Sub-Committee on "Summation of the Performance of Newer Fungicides"[1]

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1948 REPORT OF SUBCOMMITTEE ON ANNUAL SUMMARY OF RESULTS ON NEWER FUNGICIDES

The increased response of plant pathologists in the United States, Canada, and Mexico has made possible a more adequate coverage of work with the newer fungicides. Information was received from professional workers located in the United States, Canada, and Mexico. The reports include results with more than 175 different fungicides used on 65 kinds of plants. Thanks are due to all who cooperated.

This summary does not in any way represent final conclusions or imply recommendations of any sort. It is necessarily incomplete in scope as it covers only results of experiments in 1948 that were submitted to the committee by cooperators. It has been prepared solely for the information of professional people concerned with plant disease control. It probably gives a fair indication of the current trend of results with new fungicides and also brings out some of the variations in performance met with by workers in different areas. In many cases it is difficult to explain these variations. Their occurrence, however, points to the existence of important factors influencing the effectiveness or safety of the fungicides.

After reading this report, will you do the Committee the great favor of sending in your criticisms and suggestions so that next year's summary can be improved.

LIST OF COOPERATORS

State or Province	Cooperators	Place[2]
ALABAMA	Coyt M. Wilson	Auburn and Fairhope
	A. L. Smith	Auburn
ARKANSAS	E. M. Cralley	Fayetteville
	J. P. Fulton	Fayetteville
	H. R. Rosen	Fayetteville
	V. H. Young	Fayetteville
CALIFORNIA	K. F. Baker	Los Angeles
	T. de Wolfe	Riverside
	Dan Irving	Hollister
	L. J. Klotz	Riverside
	Norman Lawler	Clarksburg
	L. D. Leach	Davis
	J. W. Oswald	Davis
	Arthur H. Williams	Biggs
	C. E. Yarwood	Santa Rosa, Hollister and Fairfield
COLORADO	Ralph R. Baker	Denver and Fort Collins
	H. E. Brewbaker	Longmont
	E. F. Darley	Ault
	G. W. Deming	Fort Collins
	A. R. Downie	Rocky Ford
	J. A. Elder	Ault
	John O. Gaskill	Fort Collins
	Richard Graham	Grand Junction
	W. J. Henderson	Grand Junction and Canon City
	A. O. Simonds	Fort Collins
	R. L. Skiles	Arkansas Valley
	W. D. Thomas	Arkansas Valley, Clifton, Grand Junction, Denver, and Fort Collins
CONNECTICUT	P. J. Anderson	Windsor
	Saul Rich	Mount Carmel
	E. M. Stoddard	Mount Carmel
DELAWARE	H. W. Crittenden	Georgetown, Selbyville
	S. H. Davis	Bridgeville
	J. C. Dunegan	Dover
	M. C. Goldsworthy	Dover

[2] In most cases, place where work was done.

State or Province	Cooperators	Place
(Delaware)	J. W. Heuberger	Milton and Wyoming
	P. C. Poulos	Milton
	R. A. Wilson	Dover
FLORIDA	J. R. Christie	Sanford
	Fred Clark	Gainesville
	R. A. Conover	Homestead
	A. H. Eddins	Hastings
	A. A. Foster	Sanford
	R. R. Kincaid	Quincy
	R. O. Magie	Bradenton
	H. N. Miller	Bradenton
	G. K. Parris	Leesburg
	G. D. Ruehle	Homestead
	D. L. Stoddard	Indiantown and Belle Glade
	J. M. Walter	Bradenton
GEORGIA	J. G. Gaines	Tifton
	B. S. Hawkins	Griffin
	Bruce Blair	Idaho Falls
	W. C. Hemingway	Moscow
	Ronald Robinson	Moscow
	R. D. Watson	Moscow
	Carl Whiting	Idaho Falls
ILLINOIS	J. C. Carter	Urbana
	R. G. Emge	Urbana
	J. L. Forsberg	St. Anne
	Benjamin Koehler	Urbana
	M. B. Linn	Urbana
	D. Powell	Urbana
INDIANA	J. R. Shay	Lake Cirott
IOWA	W. F. Buchholtz	Ames
	N. Gerhold	Conesville, Ames, and Crystal Lake
	J. L. Hardy	Ames
	W. J. Hooker	Conesville, Ames, and Crystal Lake
	G. L. McNew	Ames
	Delmar Ogden	Mason City
	Charles S. Reddy	Ames

State or Province	Cooperators	Place
KANSAS	E. Abmeyer	Walthena
	A. L. Clapp	Manhattan
	Earl D. Hansing	Manhattan
	C. L. King	Manhattan
	W. W. Willis	Manhattan
LOUISIANA	J. G. Atkins, Jr.	Baton Rouge and Hammond
	D. C. Neal	Baton Rouge
	J. C. Taylor	Calhoun
MAINE	Reiner Bonde	Presque Isle
	M. T. Hilborn	Monmouth
	J. Robinson	Presque Isle
MARYLAND	C. E. Cox	Hurlock
	J. C. Dunegan	Beltsville
	W. F. Jeffers	College Park
	M. C. Goldsworthy	Beltsville
	J. E. Kotila	Beltsville
	R. W. Leukel	Beltsville
	W. D. McClellan	Beltsville
	J. E. Moore	Salisbury
	R. A. Wilson	Beltsville
MASSACHUSETTS	O. C. Boyd	Amherst
	E. F. Guba	Waltham
MICHIGAN	D. J. DeZeeuw	East Lansing
	W. F. Morofsky	Lake City
	J. H. Muncie	Lake City
	Ray Nelson	Kalamazoo and East Lansing
MINNESOTA	A. D. Baskin	Crookston
	H. W. Bockstahler	St. Paul
	C. J. Eide	University Farm
	M. B. Moore	St. Paul
	O. E. Reece	Waseca
MISSISSIPPI	D. C. Bain	Crystal Springs
	J. T. Presley	State College
MISSOURI	H. G. Swartwout	Columbia

State or Province	Cooperators	Place
MONTANA	M. M. Afanasiev	Huntley
	Ray Painter	Missoula
	R. Ralph Wood	Billings
NEBRASKA	Don Firkins	Grand Island
	W. L. Harris	Mitchel
	J. E. Livingston	Lincoln
	R. H. Moore	Union
	W. L. Schuster	Mitchel
	A. F. Sherf	Lincoln
	Orrin Webster	Lincoln
NEW HAMPSHIRE	D. R. Murphy	Durham
	F. R. Racine	Durham
	E. J. Rasmussen	Durham
	M. C. Richards	Durham
NEW JERSEY	J. C. Campbell	Cranbury
	R. H. Daines	New Brunswick
	B. H. Davis	Smithburg and New Brunswick
	B. B. Pepper	Cranbury
	R. B. Wilcox	Toms River
NEW YORK	A. W. Dimock	Ithaca
	C. H. Ford	Farmingdale
	A. A. Foster	Babylon
	J. M. Hamilton	Geneva
	A. G. Newhall	Ithaca
	D. H. Palmiter	Poughkeepsie
	W. T. Schroeder	Geneva
	D. M. Yoder	Ithaca
NORTH CAROLINA	Robert Aycock	McCullers, Boomer, Raleigh and Eagle Springs
	C. N. Clayton	McCullers, Boomer, Raleigh and Eagle Springs
	R. S. Cox	Hendersonville, Raleigh
	D. E. Ellis	McCullers, Raleigh
	J. A. Graham	Raleigh
	T. T. Hebert	Raleigh
	J. M. Jenkins, Jr.	Wilmington
	S. G. Lehman	Raleigh
	G. B. Lucas	Oxford
	E. L. Moore	Oxford

State or Province	Cooperators	Place
(North Carolina)	R. P. Scheffer	Hendersonville
	F. A. Todd	Raleigh
NORTH DAKOTA	W. E. Brentzel	Fargo
	W. G. Hoyman	Northwood
OHIO	C. A. John	Bowling Green
	H. A. Runnels	Wooster
	J. P. Sleesman	Wooster
	J. D. Wilson	Wooster
	H. F. Winter	Wooster
	H. C. Young	Wooster
OKLAHOMA	K. S. Chester	Stillwater
OREGON	J. R. Kienholz	Hood River
	A. P. Steenland	Corvallis
	E. K. Vaughan	Corvallis, Lake Lobish
PENNSYLVANIA	W. S. Beach	State College
	W. A. Chandler	State College
	H. F. Thurston, Jr.	State College
RHODE ISLAND	F. L. Howard	Kingston
	T. E. Odland	Kingston
	J. B. Rowell	Kingston
SOUTH CAROLINA	C. H. Arndt	Clemson
	U. L. Diener	Charleston
	W. M. Epps	Charleston
	H. H. Foster	Hamlin
	T. W. Graham	Florence
	C. H. Rogers	Hartsville
SOUTH DAKOTA	S. H. Edmonds	Sioux Falls
TENNESSEE	J. M. Epps	Jackson
	E. L. Felix	Knoxville
	T. R. Gilmore	Knoxville
	H. E. Heggestad	Greeneville
	D. M. Simpson	Knoxville
	W. W. Stanley	Knoxville

State or Province	Cooperators	Place
TEXAS	L. M. Blank	College Station
	D. R. Hooton	Greenville
	E. W. Lyle	Tyler
	E. C. Tullis	Beaumont
	P. A. Young	Jacksonville
UTAH	Vernal Jensen	Ogden
	Clifton H. Smith	Salt Lake City
VERMONT	A. J. Culver	Bennington
	T. Sproston	Bennington
VIRGINIA	A. B. Groves	Winchester
	W. A. Jenkins	Chatham
WASHINGTON	C. J. Gould	Puyallup
WEST VIRGINIA	J. G. Leach	Morgantown
	C. F. Taylor	Kearneysville
WISCONSIN	P. E. Hoppe	Madison
	J. D. Moore	Madison
	J. C. Walker	Starks
CANADA		
BRITISH COLUMBIA	G. E. Woolliams	Kelowna
MANITOBA	J. E. Machacek	Fort Garry
	K. Schreiber	Fort Garry
NOVA SCOTIA	K. A. Harrison	Kentville
	J. F. Hockey	Kentville
	D. G. Ross	Kentville
ONTARIO	W. C. Broadfoot	Ottawa
	G. C. Chamberlain	St. Catherines
	A. M. Leach	Ottawa
	J. Martin	Ottawa
	Ruth Mackay	Ottawa
	J. K. Richardson	St. Catherines
	A. J. Skolko	Ottawa

State or Province	Cooperators	Place
PRINCE EDWARD ISLAND	L. C. Callbeck	Charlottetown
SASKATCHEWAN	R. C. Russell	Saskatoon
MEXICO	J. S. Niederhauser	Chapingo

Some reports were received too late to be included in the summaries.

SOURCES OF CHEMICALS TESTED

Berk and Company
Commonwealth House, 1-19
New Oxford Street
London, England

F. W. Berk and Company
Wood-Ridge, New Jersey

California Spray Chemical Corporation
Elizabeth, New Jersey, or Richmond, California

Canadian Industries Ltd.
Box 10
Montreal, Canada

Carbide and Carbon Chemical Corporation
30 East 42nd Street
New York 17, New York

Central Chemical Corporation
Hagerstown, Maryland

Chipman Chemical Company
Bound Brook, New Jersey

Dominion Rubber Company
Metcalf Street
Guelph, Ontario

Dow Chemical Company
Midland, Michigan

E. I. Du Pont de Nemours and Company
Du Pont Building
Wilmington 98, Delaware

Gallohur Chemical Corporation
801 Second Avenue
New York 6, New York

General Chemical Company
40 Rector Street
New York, New York

Givaudan-Delawanna, Inc.
330 West 42nd Street
New York 18, New York

B. F. Goodrich Chemical Company
324 Rose Building
Cleveland 15, Ohio

Green Cross Insecticides
2875 Centre Street
Montreal, P. Q.

Harshaw Chemical Co.
1945 East 97th Street
Cleveland, Ohio

Imperial Chemical Industries, Ltd.
Hexagon House Blackley
Manchester, England

Innis, Speiden and Company
117 Liberty Street
New York 6, New York

Mallinckrodt Chemical Works
2nd and Mallinckrodt Streets
St. Louis, Missouri

Merck and Company, Inc.
Rahway, New Jersey

Michigan Chemical Company
St. Louis, Michigan

Micronizer Processing Company
Moorestown, New Jersey

Monsanto Chemical Company
1700 South 2nd Street
St. Louis 4, Missouri

Niagara Sprayer and Chemical Company
Middleport, New York

Onyx Oil and Chemical Company
15 Exchange Place
Jersey City 2, New Jersey

Panogen, Inc.
117 Hudson Street
New York, New York

R. J. Prentiss Company
80 John Street
New York, New York

Rohm and Haas Company
222 W. Washington Square
Philadelphia 5, Pennsylvania

Shell Chemical Corporation
100 Bush Street
San Francisco 6, California, or
50 W. 50th Street
New York 20, New York

The Sherwin-Williams Company
101 Prospect Avenue, N.W.
Cleveland, Ohio

Standard Agricultural Chemicals, Inc.
1308 Adams Street
Hoboken, New Jersey

Standard Oil Company (Indiana)
910 South Michigan Ave.
Chicago 80, Illinois

Stauffer Chemical Co.
420 Lexington Ave.
New York 17, New York, or
636 California Street
San Francisco 8, California

Tennessee Corporation
621 Grant Building
Atlanta 1, Georgia

United States Rubber Co.
Naugatuck Chemical Division
1230 Sixth Avenue
New York 20, New York

R. T. Vanderbilt Company, Inc.
230 Park Avenue
New York 17, New York

Westvaco Chlorine Products Corporation
405 Lexington Avenue
New York 17, New York

FUNGICIDES USED IN 1948

Trade Name	Active Principle	Source
Agrosan 9-N	ethyl mercury chloride + phenyl mercury acetate	Imperial Chemicals
A G 1609 B		General Chemicals
Arasan	tetramethyl thiuram disulfide	DuPont
Arasan SF	tetramethyl thiuram disulfide	DuPont
Arathane (Cr. 1639)	dinitro caprylphenyl crotonate	Rohm and Haas
Bismuth subsalicylate	bismuth subsalicylate	Monsanto
Bioquin 1	copper 8-quinolinolate	Monsanto
Bioquin 50-W	copper 8-quinolinolate	Monsanto
Bioquin 75	75% copper 8-quinolinolate	Monsanto
Bordeaux mixture	copper basic sulfates (calcium)	Homemade
Bordow	copper basic sulfates (magnesium)	Dow
Calo Chlor		Mallinckrodt
Calogree	mercuric chloride	Mallinckrodt
Carbide and Carbon 169	chromate complex	Carbide & Carbon
" " " 531	" "	" "
" " " 640	" "	" "
" " " 658	" "	" "
Carbamate H. L. -275		Calif. Spray
Cd A	inorgano Cd (20% active)	
Cd B	organo Cd (20% active)	
Cd C	organo Cd (20% active)	
Ceresan 2%	ethyl mercury chloride	DuPont
Ceresan, New Improved	" " phosphate	DuPont
Ceresan M	ethyl mercury p-toluene sulfonanilide	DuPont
C.O.C.S.	copper oxychloride sulfate	Harshaw
Compound 163	mixture of glyoxalidines	Carbide and Carbon
Compound 341 A	" "	" "
Compound 341 B	" "	" "

Trade Name	Active Principle	Source
Compound 341 C	mixture of glyoxalidines	Carbide and Carbon
Compound 531	" "	" "
Copper A Comp.	copper oxychloride	DuPont
Copper Carbonate	-----	Rohm & Haas
Copper Hydro 40	copper hydroxide	Chipman
Copper Lime Dust	copper sulfate and lime	Various
Copper quinolinolate	copper 8-hydroxyquinoline sulfate	Monsanto
Copper zinc-chromate (653)	chromate complex	Carbide & Carbon
Copper zinc-oxide	copper oxide & zinc oxide	-----
Cornell Silver Spray	silver nitrate-ferrous sulfate-lime	Homemade
Cuprocide	cuprous oxide	Rohm & Haas
D-D	dichloropropene-dichloropropane	Shell
Deecop	-----	Canadian Industries
Dithane	di-sodium ethylene bis dithiocarbamate	Rohm & Haas
Dithane cadmium	cadmium ethylene bis dithiocarbamate	" "
Dithane calcium	calcium ethylene bis dithiocarbamate	" "
Dithane D-14	di-sodium ethylene bis dithiocarbamate	" "
Dithane ferric	ferric ethylene bis dithiocarbamate	" "
Dithane magnesium	magnesium ethylene bis dithiocarbamate	" "
Dithane manganese	manganese ethylene " "	" "
Dithane zinc	zinc ethylene bis dithiocarbamate	" "
Dithane Z-78	" " " "	" "
Dithane 5880	-----	" "
DN-111	dinitro organic	Dow
Dowfume G	methyl bromide	"
Dowfume N	dichloropropene-dichloropropane	"
Dowfume W-10	ethylene dibromide	"
Dowfume W-40	" "	"
Dowicide B	sodium salt of 2,4,5-trichlorophenol	"
Dowicide C	sodium chloro-2-phenylphenate	"
Dow Rose Dust	sulfur, copper and lead arsenate	"

Trade Name	Active Principle	Source
Dow 9B	zinc trichlorophenate	Dow
Dow F-800	50% trichlorophenyl monochloro acetate	"
Dry lime-sulfur	calcium polysulfides	Sherwin-Williams
DuBay 1230BS	-----	DuPont
Elgetol	sodium dinitro cresolate	Standard Agricultural Chemicals
Everett Flotation sulfur paste	by-products sulfur	-----
Fermate	ferric dimethyl dithiocarbamate	DuPont
Fermate Rose Dust	8.75% Fermate and 84.87% sulfur	"
Flotation sulfur paste	by-product sulfur	Various
"Flo-sul 70" sulfur paste	by-product sulfur	Central Chem.
Formaldehyde	-----	Various
G 4	dihydroxy dichloro diphenyl methane	Givaudan-Delawanna
G. C. 308	copper nitrodithioacetate	General Chem.
G. C. 629	zinc nitrodithioacetate	" "
Geon latex 31	geon polyvinyl chloride latex	Goodrich
GG	organo Cd-Hg (2.4% Hg., 6.0% Cd)	-----
Glyoxalidine 341 A	mixture of glyoxalidines	Carbide and Carbon
" 341 C	mixture of glyoxalidines	" "
Goodrite P.E.P.S. (Omlite)	polyethylene polysulfides	Goodrich
Goodrite Z.A.C.	zinc dimethyl dithiocarbamate	DuPont
General 308	66% copper nitrodithioacetate	-----
General 629	66% zinc nitrodithioacetate	-----
General Cu (93-22)	copper ammonium salt	-----
H 258 D	organo Cd (20% active)	Merck
HL 225	-----	Calif. Spray
HL 331	phenyl mercury acetate	Calif. Spray

Trade Name	Active Principle	Source
IN 10425 (liquid)	manganese ethylene bis dithiocarbamate	DuPont
IN 10425 (powder)	manganese ethylene bis dithiocarbamate	"
Isothan DL-1	-----	Onyx Oil & Chem.
Iscobrome	methyl bromide	Innis, Speiden
Iscobrome D	ethylene dibromide	" "
Karbam black	ferric dimethyl dithiocarbamate	Sherwin-Williams
Karbam white	zinc dimethyl dithiocarbamate	" "
Kolofog	bentonite sulfur	Niagara Sprayer
Krenite	sodium dinitro cresolate	DuPont
Larvacide	chloropicrin	Innis, Speiden
Leytosal	2% mercury	Berk
Leytosan	7.2% phenyl mercury urea	"
Lime-sulfur	calcium polysulfides	Various
Lunasan	5% ethyl mercury thiourea	Berk
Lysol	50% tar acids + soaps	Various
Magnetic "70" paste	sulfur paste	Stauffer
Magnetic "95" sulfur	finely ground sulfur	"
Manganese ethylene bis dithiocarbamate	manganese ethylene bis dithiocarbamate	DuPont
Manganese, zinc, copper dust	manganese, zinc, copper sulfates	
Merck H-520		Merck
Merck 258A	20% cadmium organic salt	"
Merck 258C	" " " "	"
Mersolite 8	phenyl mercuric acetate	F. W. Berk
Mersolite P	2% phenyl mercuric acetate in Bentonite	"
Mercuric chloride	mercuric chloride	Various
Mercurated lead arsenate	combination of mercury and lead arsenate	
Methasan	zinc dimethyl dithiocarbamate	Monsanto
Microflotox sulfur	finely ground sulfur	Calif. Spray

Trade Name	Active Principle	Source
Microgel	tribasic copper sulfate	Tennessee Corp.
Micronized sulfur	micronized sulfur	Micronizer Processing
Mike sulfur	" "	Dow
Monocop dust	monohydrate copper sulfate	Various
M.T.H.	75% nitroso phthalimidine	Dominion Rubber
Mulsoid Sulfur	finely ground sulfur	Sherwin-Williams
Mycotox	2,4,5 trichlorophenyl	
Panogen	methyl mercury di cyan diamide	Panogen, Inc.
Parzate	zinc ethylene bisdithiocarbamate	DuPont
Parzate Liquid (Na)	sodium " "	"
Parzate Liquid (Ca)	calcium " "	"
Peps	polyethylene polysulfide	Goodrich
Perenox	copper oxychloride	Canadian Industries
Phenyl mercury acetate	phenyl mercury acetate in bentonite	F. W. Berk
Phenyl mercury fixtan	phenyl mercury hydroxide + naphthalene sulfonic acid	Imperial Chemicals
Phygon	dichloronaphthoquinone	U. S. Rubber
Phygon (wettable)	"	"
Phygon XL	"	"
Phygon XLCS	calcium sulfate safener added to Phygon	"
Phygon XLMS	magnesium " " " " "	"
Puratized Agricultural Spray	phenyl mercury triethanol ammonium lactate	Gallohur, Niagara
Puratized B	phenyl mercury monoethanol ammonium acetate	Gallohur
Puratized 111-5	organic (4% Hg - 4% Cu)	"
Puratized FS - 33	100% substituted ammonium salt	"
Puratized SPC	100% phenyl mercury salt	"
Puraturf 177	phenyl amino cadmium lactate	"
R-118A	mercury	Green Cross Insectide
R1078 x 67	same as Agrosan with 5% mercury	Imperial Chemicals
R1078 x 73	6% phenyl mercury acetate	Imperial Chemicals
R-1856	-----	Niagara Sprayer

Trade Name	Active Principle	Source
7R2312	organic Cd (20% active)	Merck
RE 358	dimetacresyl trichloroethane	Calif. Spray
Rose Dust	sulfur, copper, rotenone, and DDT	Michigan Chem.
Rosineamine-silver nitrate	rosineamine-silver nitrate	
S. C. R. 21 770	50% ethyl carbonate trichlorophenol	-----
Salicylic acid	salicylic acid	Various
Seedox	50% trichlorophenyl acetate	R. J. Prentiss
Semesan	30% hydroxymercury chlorophenol	DuPont
Semesan, Jr.	ethyl mercury phosphate	DuPont
Silver nitrate	silver nitrate	Various
Soilfume 80-20	ethylene dibromide	Westvaco
Spergon	tetrachlorobenzoquinone	U. S. Rubber
Spergon (Wettable)	tetrachlorobenzoquinone	U. S. Rubber
Standard Oil 408	-----	Standard Oil
Standen #307	2,4,5 trichlorophenyl acetate	-----
Stauffer 411 dust	-----	Stauffer Chem.
Sulfur	finely ground sulfur	Various
Sulfur dust	finely ground sulfur	Various
Sulfuron	micronized sulfur	DuPont
Sulphuron X	-----	DuPont
Tennessee Copper 26	copper basic sulfate	Tennessee Corp.
Tennessee Copper 34	copper basic sulfate	Tennessee Corp.
Tersan	tetramethyl thiuram disulfide	DuPont
Tribasic copper sulfate	copper basic sulfate	-----
Yellow Cuprocide	yellow cuprous oxide	Rohm and Haas
Z.78	zinc ethylene bis dithiocarbamate	Rohm and Haas
Z.A.C.	zinc dimethyl dithiocarbamate cyclohexylamine	-----

Trade Name	Active Principle	Source
Zerlate	zinc dimethyl dithiocarbamate	DuPont
Zinc Copper Bordeaux	zinc and copper basic sulfate	Homemade
Zinc Hg chromate	zinc 40%, Hg 15%, chromium 40%	Carbide and Carbon
Zinc sulfate lime	basic zinc sulfate	Homemade

RESULTS WITH FRUIT DISEASES

APPLES

Reports were received from Colorado, Illinois, Iowa, Indiana, Kansas, Maine, Massachusetts, Missouri, Nebraska, New Jersey, New York, New Hampshire, North Carolina, Nova Scotia, Ohio, Ontario, Oregon, Pennsylvania, Rhode Island, Virginia and West Virginia.

SCAB

The reports submitted in 1948 indicated a light to moderate infection in the eastern, New England and Canadian sections. In the Atlantic Coast States infection was most severe in Virginia, Maryland, Delaware, and New Jersey. In Pennsylvania and New York and in the middle States initial infection was heavy but dry weather during the late spring and summer held down secondary infection. From nearly all the reports received it appeared that the materials used this year were subjected to good tests. Several very warm periods in the summer caused scald of leaves and fruits in many of the States.

Phygon, Fermate, Puratized Agricultural Spray, 341-C, Bioquin 1 (50 W) manganese ethylene bis dithiocarbamate, micronized sulfur, flotation pastes and Magnetic "70" paste were used most frequently by the investigators. Lime-sulfur, Cr. 1639, Goodrite Z-A-C, wettable sulfur, mike sulfur, microflotox, 341 B, magnetic "95", Flo-sul paste, Stanofide, Krenite, DN-111, Bordeaux mixture, mulsoid sulfur, Sulfuron, Karbam black, Goodrite p.e.p.s., Parzate, Z.78, G.L.F.#4, Dithane, mercurated lead arsenate, General 629, General 308, General Cu (93-22), Merck 258A, Merck 258C, Puratized 111-5, Puratized FS-33, Puratized SPC, and Puratized B were used occasionally.

Combination sprays consisting of Phygon-sulfur, Phygon-Fermate, Puratized-Fermate, Puratized-micronized sulfur, Puratized-mike sulfur, Puratized-Phygon, Puratized-Bioquin 1, Fermate-manganese carbamate, sulfur-manganese carbamate, HL 331-micronized sulfur, Phygon-micronized sulfur, Parzate-micronized sulfur, Z.78-Micronized sulfur and Karbam black-micronized sulfur were used. Such mixtures appeared more frequently in the schedules this year than ever before. It is not certain, from the reports submitted, that such a practice has led to any particular advantage over the scab organism. Where controls have been used not much difference was observed. In general, such mixtures reflected the effect of the most potent of the constituents. Manganese ethylene bis dithiocarbamate appeared to be helped by the addition of sulfur and Fermate. With the others, combination sometimes helped and sometimes decreased their efficiency. With the mercury compounds, it is not certain that this is a good practice since reactions may occur to cut down the effectiveness of these materials.

Spreaders and stickers, such as polyethylene polysulfide, Orthex and Graselli spreader-sticker were frequently used to fix the materials more firmly on the leaves and fruits or to reduce the quantities of spray materials used. Some benefit was noted in stepping up control with sulfurs and Fermate with this method. Lime was used occasionally with 341 C and calcium sulfate and magnesium sulfate were used with Phygon for safening purposes.

Phenyl mercury acetate (HL 331), 2,3-dichloro 1-4-napthoquinine (Phygon), glyoxaladine (341 c), ferric dimethyldithiocarbamate (Fermate, Karbam) and phenyl mercury triethanolammonium lactate (Puratized Agr. Spray) were consistently the best fungicides used during the 1948 season. The sulfur materials in general appeared to disadvantage during this season, and this no doubt reflects their inability to cope with the disease during a year when the fungus was most active. In only a few cases were they ranked among the best. Copper-8-hydroxyquinoline (Bioquin 1, Bioquin 50 W) performed erratically as a fungicide being, in some tests, among the best and in some cases, among the poorest of the performers. Parzate, Z.78, Goodrite p.e.p.s., Goodrite Z.A.C, Cr. 1639, Stanofide, and mercurated lead arsenate behaved poorly during the season.

Considering the results from the plant injury side of the picture it appears beyond question that Phygon is not, as yet, able to take its place among our apple fungicides. The material causes too much foliage and fruit injury and was responsible for reducing the size of the fruit, premature thinning (drops) and, apparently, alternate bearing in some cases. Corrective measures also failed to eliminate the dermatitis which is sometimes experienced with this compound. Glyoxalidine 341 c appeared to be unfavorable to plant tissue in some of the tests. In Illinois, Pennsylvania, and Nova Scotia the material apparently weathered the season without causing leaf or fruit injury. In Indiana leaf spotting but no fruit russet was observed. In New Jersey, New York, Ontario, and Virginia fruit russeting was common when this material was used. West Virginia reported a change in the color of the leaves while Ohio reported it as being injurious to both leaves and fruit. In New York one report indicated that fruits sprayed with this compound scalded during hot weather. Lime was sometimes added as a safener to 341 c but the results do not indicate that this was wholly effective.

Puratized Agricultural Spray when not mixed with lime or not used late in the cover sprays failed to cause any leaf or fruit injury. When used in the late covers, one State reported leaf yellowing. Where lime was added to such a material some injury was noted in New York State. It was also noticed that additions of lead arsenate also caused deleterious changes to take place.

HL 331 (Phenylmercury acetate) was only observed to cause any signs of leaf injury when lime or lead arsenate were added to the compound. Some leaf yellowing developed in these cases. This was also true of Puratized B (Phenyl mercury monoethanol ammonium acetate).

Fermate again performed very well from a plant injury standpoint. When mixed with Phygon it appeared to increase the injury caused by Phygon but in every other case it gave good foliage, good fruit finish and appeared to increase fruit size and crop.

Bioquin 1 (5C W), Puratized FS 33, Puratized 111-5, General #308, General #629, General Cu (93-22), Parzate, Cr. 1639, Z.78, and lime sulfur, all caused appreciable injury to leaves and fruits and all the sulfur materials were responsible for varying leaf and fruit injuries. Manganese carbamate was observed as causing excessive fruit drop in New York and some fruit injury in Illinois.

RUST

One rust experiment was described from Virginia. Phygon, Compound 341, Puratized Agricultural Spray, HL 331, Bioquin 1, Manganese carbamate and Fermate were used on York and Jonathan varieties. Fermate proved to be the best for rust. Phygon, Bioquin 1, 341, Manganese carbamate, and the mercury materials proved to be not useful.

BITTER ROT

Phygon XL, Fermate, Bioquin 50W, a mixed schedule of Puratized Agricultural Spray and Zerlate, and a mixed schedule of dry lime-sulphur and bordeaux, were effective in North Carolina. Wettable sulfur was ineffective and caused early defoliation. Bioquin 50W and the lime-sulfur-bordeaux schedule caused some fruit russet and leaf injury.

BLOTCH

Nebraska reported one test on the Duchess variety. Lime sulfur in petal fall followed by bordeaux on 5 cover sprays was equal to Fermate used in petal fall and covers as to disease control. Fermate was superior as far as safety was concerned.

FIRE BLIGHT

Two applications of Dithane Z-78, one at 10% full bloom and one at full bloom gave good control in Colorado. Two applications of zinc sulfate or one application of Dithane Z-78 at 10% bloom gave fair control. One application of zinc sulfate at 10% bloom gave very poor control.

MILDEW

Powdery mildew appears again to be a problem in the Pacific Northwest. One test was reported on from Oregon where mildew was found attacking the Ortley variety. Fermate, Puratized Agricultural Spray, DN-111, Krenite, 341 C, Dry lime-sulfur-wettable sulfur (split schedule) and Cr. 1639 (Arathane) were used in the pink and calyx stages of growth. The standard materials, dry lime-sulfur and wettable sulfur proved to be the best, being considerably more effective than the next best (Cr. 1639) material. Puratized Agricultural Spray, DN-111, Krenite, Fermate, and 341c proved to be ineffective in controlling the disease.

PEARS

FRUIT ROTS

In one test described from Oregon, a Dowicide C wash was used in comparison to an acid wash to control fruit rotting. The fruit was dipped for 3 to 5 minutes and then rinsed before packing. Such a procedure reduced the rot from 5.9% in the check to 1.8% in the treatment with Dowicide C. The use of such a material requires good ventilation in the sorting and packing rooms to avoid irritation from the vapors from the material.

FIRE BLIGHT

Two applications of Dithane Z-78, one at 10% full bloom and one at full bloom, gave good control, or one application at full bloom gave fair control in Colorado. Poor control was obtained with Puratized Agricultural Spray, PAS, and zinc sulfate.

CHERRIES

LEAFSPOT

One report on leaf spot was sent in from Nebraska where a variety of sour cherries were sprayed with lime-sulfur-bordeaux mixture (split schedule), Fermate, 341B and Phygon on one test and without Phygon in another test. The materials were used at petal fall, 2 covers and one post-harvest in a four spray schedule. In the first test all of the materials performed well in holding the fungus while in the other none of the materials proved effective. This difference was attributed to the failure of getting a good coverage in the second test, a test in which a spray mast was used for application. In the lime-sulfur-bordeaux mixture plots early leaf fall was experienced. No yield data was obtained.

In Ontario sweet cherries were sprayed with Fermate, Compound 341B, Phygon XL and C.C.C.S. plus lime. Only one application at post-harvest was made. Under these conditions Fermate proved to be the best and the copper material caused some leaf yellowing.

BROWN ROT

Two tests were submitted from Oregon. In one test an application of Krenite, 3 pints in 100 gallons of spray fluid, was applied at the rate of 15 gallons to a tree at the pop-corn or pre-bloom stage of growth. This material killed about 60% of the bloom but at harvest time a larger and cleaner yield of fruit was harvested from the Krenite treated trees. Blossom blight was reduced from 84% in the untreated trees to 8% in the treated trees. No doubt some of this reduction can be traced to blossom elimination by the treatment. In another test in Oregon bordeaux mixture, Phygon (2 strengths) sulfur, Zerlate, Fermate, Parzate, Z.78, 341B, and Puratized Agricultural Spray were applied at early pop-corn, early bloom and late bloom periods. Bordeaux was the only material that appeared to cause injury. In this case the pistils, stamens and petals of the blooms were observed as being blasted. Puratized, Phygon and 341B all proved about equal and best in controlling the disease while bordeaux mixture, Parzate and Z.78 were considered as being not worthy of further trials. Phygon was apparently responsible for increasing the yield.

PEACHES

BROWN ROT

The disease, from all sources of information, was very severe on peaches in all of the northern peach growing States and especially so in Virginia, Delaware, Maryland, and New Jersey during 1948. Experiments were reported on from South Carolina, North Carolina and Delaware. Two tests showed the effect of controlling blossom blight on fruit rot at harvest time and several were developed to show the effect of spraying during the pre-harvest period on the disease at harvest time.

In the two blossom experiments Phygon, Fermate, dilute lime sulfur, and sulfur were compared. In both tests the incidence of blossom blight was low. Significant reductions, by the treatments, in the amount of blossom blight resulted in a decrease in fruit rot at harvest time. In the tests where sprays were compared for the control of fruit rot at harvest time quite a few materials were used. In one test in Delaware, Sulfuron, Zerlate, Fermate, Parzate, Parzate-Zerlate, Bioquin 1, Phygon, and self-boiled lime-sulfur were used throughout the season. The last mixture proved to be the best but was not significantly better than Sulfuron, Fermate, Parzate or mixtures of these with lime or with each other. Phygon and Bioquin 1 were distinctly inferior to the above. In a strictly pre-harvest experiment in Delaware where fungicides were used just prior to harvest, sulfur, lime-sulfur, Dithane, Parzate, Zerlate, and Bioquin 1 were compared. The lime-sulfur was used at varying dilutions and in combination with stickers and with Dithane and also zinc lime. All of the other materials were used with a sticker. The results indicated at harvest time that the Bioquin 1 plot had the lowest percentage of rot and the Parzate plot was next best. Poor control was obtained with the other materials. Foliage injury was observed in the lime-sulfur, Dithane, and Parzate plots. On the Dithane treated trees this was severe. In a similar test at Bridgeville and Rising Sun, Delaware, no significant differences could be observed in the control of fruit rot by applications of sulfur, Bioquin 1, or liquid lime-sulfur.

Pre-harvest applications of Phygon and dry lime-sulfur were effective in North Carolina following wettable sulfur-zinc-lime-arsenic applications but considerable arsenical injury developed in the Phygon plots. Wettable sulfur was less effective and Zerlate gave poor control.

BACTERIAL SPOT

Two reports were received from New Jersey. In one the tests cover a period of three years in which over 20 compounds have been used to control the bacterium that causes this disease. Of the many materials used zinc sulfate-lime, Delmo-Z-lime, copper-8-quinolinolate-lime and Tennessee copper-26 have given the best control of the disease on the fruits. Sulfur, dithiocarbamates, Phygon, and Glyoxalidine 341B gave no protection. Where the zinc-lime spray was used, in this State, a great deal of leaf injury and subsequent defoliation occurred. This effect appears to be peculiar to New Jersey. In the other test covering two years of experiments, the zinc-lime spray and Tennessee copper-26 proved the best for control in 1947, but in 1948 neither were very efficient. Phygon, zinc-8-quinolinolate, and sulfur failed to have any effect in controlling this disease.

SCAB

Two to four pre-harvest applications of Phygon, dry lime-sulfur, wettable sulfur and Zerlate following sulfur-zinc-lime-arsenic applications were equally effective in controlling scab in North Carolina. Arsenical injury was increased by the Phygon and the Zerlate applications. Much less arsenical injury occurred when only two Zerlate applications were made than when three or four were made.

LEAF CURL

Experiments to control this disease were set up in Oregon during 1948. In one test in the Willamette Valley bordeaux mixture, Zerlate, Phygon, and liquid lime-sulfur were used during the January dormant period. All four materials gave good commercial control but bordeaux mixture proved to be the poorest of the lot. Liquid lime-sulfur, however, caused a lot of bud killing but at harvest time all treatments gave about an equal crop of fruits.

APRICOTS

BROWN ROT

In one test near Hollister, California, Fermate and bordeaux mixture were applied as sprays at the full bloom and at the petal fall stages of blossom development to control twig blight. The untreated trees showed 32 percent twig blight while Fermate and bordeaux mixture reduced this to 6 and 15 percent, respectively, when applied at full bloom stage. When Fermate was applied only in petal fall, 20 percent of the twigs were infected but when applied at full bloom and petal fall only 1 percent of twig blight occurred.

JACKET ROT

In this disease, where the attack usually takes place when the small fruits still have their calyxes attached to them, Fermate was used at full bloom, at petal fall, and both at full bloom and petal fall. In the untreated trees the percentage of jacket rot was found to be rather low and amounted to only 7 percent. Treatment at full bloom and petal fall reduced this figure to 1 percent. Two percent developed when only a petal fall application was made while a full bloom spray reduced it to 3 percent.

GRAPES

BLACK ROT

One report was received from Florida and two from Missouri concerning this disease. Compound 658, 341-c, Z.78, and Tennessee copper-26 were used in the Florida test. Since the amount of disease that developed was of minor importance nothing was discovered concerning the relative values of the four materials used. Z.78 caused the least discoloration of the fruit. In Missouri at Rosate, a five application schedule with Karbam Black, Fermate, Dithane-zinc-lime, and Fermate plus Phygon was used. Fermate plus Phygon (1-1/3-100) gave the best control but the berries were russeted by Phygon. Either Fermate or Karbam black were next best in control and neither caused any injury. At Columbia, Missouri, Fermate, bordeaux mixture and Stanofide were compared and Fermate proved to be the best. Stanofide and bordeaux mixture caused stunting and Stanofide curled the grape leaves. Considering the work done during the season in the various vineyards in Missouri, the cooperator indicated that Fermate and Karbam black are rated the best materials for controlling black rot.

DOWNY MILDEW

Bordeaux mixture (2 concentrations), Bordow and Phygon XL were compared in Ontario for control. The two concentrations of bordeaux mixture used were also compared when mixed with stickers (Orthex and P.E.P.S.). The disease was quite severe on untreated vines, averaging about 75 percent infection. After applications were made at pre-bloom, fruit set and 2 weeks later, the disease was controlled best by a bordeaux mixture, without sticker, consisting of 7.5 pounds of copper sulfate and 10 pounds of hydrated lime in 100 gallons of water. Phygon gave the poorest control. The addition of stickers to bordeaux mixture lowered its efficiency considerably. The efficiency of Bordow was about equal to the weaker bordeaux mixture containing the stickers. Bordow apparently was the only copper material used that did not cause leaf scorch. Phygon caused fruit russet and chlorosis. Apparently the most important application was at the pre-bloom period.

CRANBERRIES

FRUIT ROTS

Control of fruit rots caused by Guignardia and Acanthorynchus was studied in New Jersey. Fermate, Zerlate, and Parzate were used. Fruit rot was not high in the unsprayed checks, being 26.6%, and all of the dithiocarbamates behaved about the same in bringing the disease down to around 10%. All of the materials were used at the rate of 3 pounds to 100 gallons and 250 gallons of spray were used per acre of cranberries.

RASPBERRY

ANTHRACNOSE AND SPUR BLIGHT

At St. Catherines, Ontario one delayed dormant application of Krenite and two summer applications of Fermate, Fermate plus P.E.P.S., Phygon, and Phygon plus P.E.P.S. were used to control the two diseases. Phygon was found to be the best material for the control of both diseases. Apparently the additions of the sticker failed to augment control. Phygon was observed to cause a slight russeting of the canes, but this was not important.

YELLOW RUST

A single early season application of Elgetol, Phygon, Fermate, lime-sulfur and a combination of Tribasic copper sulfate-zinc sulfate was applied to Cuthbert and Washington red raspberry plants and to the adjacent soil cover in Oregon to control this disease. 300 gallons of Elgetol and 200 gallons of the other materials were used per acre. Good control of early summer infections were obtained through the use of Elgetol 2 qts.-100, Phygon 2-100, Fermate 2-100, and lime-sulfur 4-100. No injury developed in any plot.

STRAWBERRY

FRUIT ROTS

In Tennessee CR 1639 at a concentration of 1/3 lb. of the active ingredient in 100 gal. and Mycotox dust (0.5 and 1.0%) caused injury. CR 1639 at 1/8 lb. active in 100 gal. and G-4 (up to 16% dust) did not cause injury. There was insufficient rot to evaluate disease control.

CITRUS

LEMON BROWN ROT

Lemon fruits were treated with a large number of chemicals in one test in California for the control of the *Phytophthora* brown rot disease. In some cases the materials were applied as sprays while in others the lemons were dipped in suspensions of the compounds in water. Significant and large reductions in diseased fruits were obtained by using ferric ethylene bis dithiocarbamate, Carbide and Carbon numbers 169, 531, 640, and 658 (complex chromates), Cr. 1639 (Arathane), homemade bordeaux 1-1-100, Phygon XLMS, zinc-copper-bordeaux mixture 5-1-4-100, California Spray number RE358, magnesium ethylene bis dithiocarbamate, Goodrite zinc dithiocarbamate-cyclohexylamine complex, G4, and a silver nitrate-lime mixture 1/16-1/16-100. Of these compounds Phygon XLMS produced a non-removable stain on the lemon fruits.

RESULTS WITH VEGETABLE DISEASES

Wherever possible, results have been presented by placing the materials in groups of approximately equal control or yield. Injury data are listed as reported by the cooperator. No entirely new organic compound was reported, but several variations of old ones appeared. Dithane Z-78 and Parzate were tested more widely than in 1947; the same is true for Zac, Copper-Zinc-Chromate (658), and Manganese ethylene bisdithiocarbamate (IN-10425). Tank-mix combinations of Zerlate-Parzate, etc., received further testing, and even tank-mixes of Zerlate and Fixed Coppers were reported. Alternating schedules continued to be tested on tomatoes, and split schedules of a dithiocarbamate and Bordeaux appeared more frequently than in 1947. (3-4) appearing after a split schedule indicates number of applications of each.

Dithane D-14 and Liquid Parzate were used with the addition of zinc sulfate only; they are listed in the text as Dithane D-14 and Liquid Parzate. Wherever Zerlate-Parzate appears, or Zerlate-Tribasic, it means a tank-mix; when the ratio of materials is known it is indicated, e. g., (1-1).

In practically all tests on potatoes, DDT was used in combination with the fungicides.

Dust tests are so indicated; all others are spray tests.

POTATOES

LATE BLIGHT

MEXICO (Campo Experimental Station, Chapingo): Descending control order was: (1) Bordeaux; (2) Copper A Compound, COCS; (3) Zerlate; (4) DDT. Bordeaux mixture caused slight stunting and tip burn. Descending yield order was: (1) Copper A Compound, COCS; (2) Bordeaux; (3) Zerlate; (4) DDT. Cooperator's note: "Zerlate is no good for blight control".

FLORIDA (Homestead): Descending control order was: (1) Dithane D-14; (2) Parzate; (3) Copper Hydro 40, Bordeaux, Cuprocide, Tribasic; (3) Copper-Zinc-Chromate, Copper A Compound, HL 275, General Chemical 629 plus 308. Injury: Cuprocide, Bordeaux, and Copper-Zinc-Chromate caused slight stunting. Descending yield order was: (1) Dithane D-14; (2) Parzate; (3) Tribasic, Copper Hydro 40, Cuprocide, Bordeaux, Copper A Compound; (4) Copper-Zinc-Chromate, HL 275, General Chemical 629-308; (5) Untreated. Over-all preference covering 1 to 10 years of research: (1) Dithane D-14; (2) Parzate; (3) Copper A Compound, Tribasic, Cuprocide, Copper Hydro 40; (4) Bordeaux; (5) Copper-Zinc-Chromate; (6) HL 275; (7) General Chemical 629-308. Copperator's note: "Copper-Zinc-

Chromate (658), HL 275 (a Zn carbamate), and Gen. Chemical 629-308 (a mixture of copper and zinc nitro dithioacetates) not worthy of further trial under our conditions."

NEW JERSEY: Descending control order was : (1) COCS, Bordeaux; (2) Tribasic, Copper-Zinc-Chromate, Parzate, 406; (3) Dithane D-14; (4) Zerlate; (5) Untreated. No injury observed. Dithane D-14 gave the highest yield of any fungicide but differences in yield were not significant over that of the Untreated. No one material received preferential rating. Cooperator's note; "Zerlate not worthy of further trial."

PRINCE EDWARD ISLAND: Descending control order was: (1) Phygon XL; Parzate; (3) Bordeaux, Bordow, COCS Niatox; (3) Deecop, Dithane D-14; (4) General Chemical 629, Untreated. Injury: Phygon XL delayed maturity. Descending yield order: (1) COCS Niatox, Bordow, Parzate; (2) Bordeaux; (3) Dithane D-14, Deecop, Phygon XL; (4) General Chemical 629; (5) Untreated. Over-all preferential rating in descending order: (1) Parzate; (2) COCS, Bordow; (3) Bordeaux; (4) Deecop, Dithane D-14. Cooperator's note: "Fungicide 629 absolutely failed to control blight under the severe conditions of the experiment and is not worthy of further trial. Outstanding disease control was shown by Phygon XL, but because it exhibited such a propensity to delay maturity it is expected that this fungicide would never be suitable in this Province."

RHODE ISLAND: Spray Concentrate Test. This test is not reported in detail. However, two of the compounds used (Puratized 111-5 and Procop 110 E) gave excellent control. Puratized 111-5 gave no injury and Procop 110 E caused some foliage injury. These two materials gave the highest yields. Cooperator's note: "Materials were compatible with DDT. Oil-soluble fungicides are less injurious and more effective when applied as emulsions rather than in oil alone as the carrier. Puratized 111-5 is a specific eradicant fungicide for late blight."

EARLY BLIGHT

MICHIGAN: Descending control order was: (1) Copper-Zinc-Chromate; (2) Zerlate, Cuprocide, Dithane D-14; (3) Parzate, Copper-Zinc Oxide, Copper-8-Quinolinolate; (4) Zinc Nitrodithioacetate, Copper-Zinc- Nitrodithioacetate, Dithane Z-78. No injury noted. Descending yield order was: (1) Zinc Nitrodithioacetate, Dithane D-14, Parzate; (2) Copper-Zinc Oxide, Zerlate, Dithane Z-78, Copper-Zinc-Nitrodithioacetate; (3) Copper-8-Quinolinolate, Copper-Zinc-Chromate; (4) Yellow Cuprocide.

In a dust test, Zerlate, Copper-Zinc-Chromate, Copper-8-Quinolinolate, Tribasic, Dithane Z-78, and Zinc Nitrodithioacetate all gave very good early blight control. Yield differences were not significant.

A series of demonstration tests was made in eight counties. Late Blight was present in only one test and Early Blight was present in all the others but was not serious. Yield data only were presented. Analysis of this data (Bu./A) for the spray tests shows the following:

1. Seven tests -- Bordeaux, 467.6; Dithane Z-78, 478.9
2. Six tests -- Tribasic, 444.8; Bordeaux, 459.5; Dithane Z-78, 467.7
3. Two tests -- Bordeaux, 505.5; Dithane Z-78, 518.5; Dithane D-14, 552.5
4. One dust test -- Basicop, 444; Tribasic, 432; Dithane Z-78, 402

WISCONSIN: Descending control order: (1) Dithane D-14, Parzate, Copper-Zinc-Chromate; (2) Tribasic, Zerlate, COCS; (3) Bordeaux; (4) Untreated. No injury noted. Yield in descending order was: (1) Dithane D-14, Parzate; (2) Copper- Zinc Chromate; (3) Zerlate, Tribasic, COCS; (4) Bordeaux; (5) Untreated. Over-all preferential rating is as above yield order.

CALIFORNIA: Spray and dust test. Descending control order was: (1) Parzate spray, 74% control; (2) Zerlate dust, 25% control; (3) Untreated, no control. No yield data presented.

DELAWARE: Test No. 1. Descending control order was: (1) Dithane D-14; (2) Dithane Z-78, Parzate, Manganese ethylene bisdithiocarbamate, Zerlate-Parzate (1-1); (3) Bordeaux, Zac; (4) Zerlate, Tribasic; (5) Untreated. No injury noted. Descending yield order was: (1) Dithane D-14; (2) Parzate, Zac, Manganese ethylene bisdithiocarbamate; (3) Zerlate, Dithane Z-78; (4) Zerlate-Parzate (1-1), Tribasic, Bordeaux; (5) Untreated.

Test No. 2. Descending control order was: (1) Dithane D-14, Liquid Parzate; (2) Yellow Cuprocide, Bordeaux; (3) Copper-Zinc-Chromate (658), Copper A Compound; (4) General Chemical 629, 308, and 629-308; (5) Untreated. Descending yield order was (1) Dithane D-14, Liquid Parzate; (2) Copper-Zinc-Chromate, Bordeaux; (3) Yellow Cuprocide; (4) G.C. 308 and 629-308; (5) Copper A Compound, G.C. 629; (6) Untreated.

TENNESSEE: No control data presented. No injury observed. Descending yield order was: (1) Bordeaux, Untreated; (2) COCS, Parzate, Tribasic, Cuprocide dust; (3) Dithane D-14, Copper A Compound. The Copper A Compound was significantly lower than Bordeaux.

LATE BLIGHT AND EARLY BLIGHT

ALABAMA: Spray and dust test. Descending control order was: (1) Dithane D-14, Phygon; (2) Dithane Z-78 dust, Parzate dust, Neutral Copper dust; (3) G.C. dust; (4) Untreated. Injury: Copper dust stunts plants and Phygon spray delays maturity. Descending yield order was: (1) Dithane D-14, Dithane Z-78 (6%) dust, Neutral Copper dust, Parzate;

(2) G.C. dust, Dithane Z-78 (3.9%) dust; (3) Phygon, Untreated. Over-all preferential rating: (1) Dithane D-14 spray; (2) Parzate spray and Dithane Z-78 (6%) dust.

IOWA: Descending control order was: (1) Dithane D-14, parzate, Copper-Zinc-Chromate, Manganese ethylene bisdithiocarbamate; (2) Dithane Z-78, Tribasic, Bordeaux; (3) Zerlate; (4) Untreated. No injury noted. Descending yield order was: Dithane D-14, Parzate, Manganese ethylene bisdithiocarbamate, Tribasic; (2) Z-78, Copper-Zinc-Chromate, Zerlate; (3) Bordeaux; (4) Untreated.

OHIO (Wooster): Descending control order was: (1) 658, Parzate, Tribasic A, Dithane Z-78, Zerlate; (2) Tribasic, Zac; (3) 629; (4) Untreated. No injury noted. Descending yield order was: (1) Parzate; (2) Dithane Z-78, 658; (3) Zerlate, Tribasic A; (4) Zac, Tribasic, 629; (5) Untreated. Over-all preferential rating was: (1) Parzate; (2) Dithane Z-78, 658; (3) Zerlate, Tribasic A; (4) Tribasic, Zac, 629. Cooperator's note: "629 of questionable value."

OHIO (Marietta): Descending control order was: Tribasic A, Dithane Z-78, Tribasic; (2) Parzate, 658; (3) Zerlate; (4) 629, Zac; (5) Untreated. No injury of consequence. Descending yield order was: (1) Parzate; (2) Dithane Z-78; (3) Zerlate; (4) Tribasic A, Tribasic; (5) 658; (6) Zac; (7) 629; (8) Untreated. Cooperator's note: "629 of questionable value."

MINNESOTA: Test No. 1. Descending control order was: (1) Bordeaux; (2) Parzate, Copper-Zinc-Chromate, Dithane Z-78; (3) Tribasic, COCS; (4) Zerlate; (5) Untreated (DDT alone). No injury observed. Descending yield order was: (1) Dithane Z-78, Parzate, Zerlate; (2) Tribasic, Bordeaux, COCS, Copper-Zinc-Chromate, Untreated (DDT).

Test No. 2 (Dust.) Descending control order was: (1) Dithane Z-78; (2) Copper-Zinc-Chromate, COCS, Tribasic; (3) Parzate, Copper-Lime; (4) Zerlate; (5) Untreated (DDT). No injury of consequence. Descending order was: (1) Tribasic, Zerlate; (2) Dithane Z-78, Copper-Zinc-Chromate; (3) COCS, Parzate; (4) Untreated (DDT); (5) Copper-Lime.

RHODE ISLAND: Descending control order was: (1) Dithane Z-78; (2) General Chemical 629-308; (3) General Chemical 629; (4) Untreated. No injury reported. Descending yield order was: (1) Dithane Z-78; (2) General Chemical 629-308; (3) General Chemical 629; (4) Untreated. Over-all preferential rating: (1) Dithane Z-78. Cooperator's note: "The copper form (#308) is worth additional trial but I believe that the Zinc form (629) is not, under Rhode Island conditions."

MAINE: Descending control order for <u>Early Blight</u> was: (1) Dithane Z-78; (2) Dithane D-14, Bordeaux, Tribasic; (3) Copper-Zinc-Chromate, COCS; (4) Zerlate; (5) Parzate; (6) Untreated. Descending control order for Late Blight was: (1) Bordeaux, Tribasic; (2) Dithane Z-78, COCS, Copper-Zinc-Chromate; (3) Parzate, Dithane D-14; (5) Zerlate; (6) Untreated. Injury: Copper-Zinc-Chromate caused slight yellowing and Bordeaux dwarfed the plants. Descending yield order was: (1) Zerlate, COCS, Dithane Z-78, Tribasic, Dithane D-14; (2) Copper-Zinc-Chromate, Parzate; (3) Bordeaux; (4) Untreated. First five preferential treatments are Tribasic, Bordeaux, Dithane Z-78, Dithane D-14, and Parzate.

WEST VIRGINIA: No control data presented. No injury observed. Materials in descending yield order are Bordeaux, Tribasic plus sticker, Copper-Zinc-Chromate, Tribasic alone. Cooperator's note: "Unusually heavy rainfall. In normal seasons Tribasic would equal Bordeaux and is much less trouble. Expense and availability places #658 (Copper-Zinc-Chromate) low in preferential rating. We recommend Tribasic plus sticker."

DISEASE OF NO SIGNIFICANCE

NORTH DAKOTA: Descending order of yield was: (1) Parzate dust, Parzate, Dithane D-14, Tribasic plus "Nu-Zinc"; (2) Zinc Nitrodithioacetate (629), Copper-Zinc-Chromate; (3) Zerlate dust, Dithane Z-78 dust; (4) Cuprocide dust, Tribasic dust, Tribasic; (5) Untreated (DDT).

NEW JERSEY: Dust Test. Descending order of yield was: (1) Tribasic, Copper-Zinc-Chromate; (2) Dithane Z-78, Untreated, Copper-Lime; (3) Yellow Cuprocide.

TOMATOES

ANTHRACNOSE

NEW JERSEY (New Brunswick): Descending control order was: (1) Bordeaux, Zerlate-Tribasic alternating, Zerlate; (2) Tribasic, Parzate, Dithane Z-78; (3) Untreated. Differences were not significant -- Untreated had only 3%. No injury observed. Yield in descending order was: (1) Untreated, Parzate; (2) Zerlate-Tribasic alternating, Dithane Z-78, Tribasic, Zerlate; (3) Bordeaux. No significant difference in yields. Cooperator's note: "Zerlate preferred for anthracnose."

NEW JERSEY (Smithburg): Descending control order was: (1) Zerlate -- 16%; (2) Zerlate-Tribasic alternating -- 27%; (3) Tribasic -- 40%; (4) Untreated -- 49%. No injury observed. Descending yield order was: (1) Tribasic, Zerlate-Tribasic alternating, Zerlate; (2) Untreated. Over-all preferred material -- Zerlate.

OHIO (Freemont): Descending control order was: (1) Zerlate -- 10%, Parzate -- 11.9%; (2) Zerlate-Tribasic alternating -- 12.4%; (3) Dithane Z-78 -- 14.4%, Zac -- 1?.4%; (4) 658 -- 18.9%; (5) Tribasic -- 22.3%;

(6) 629 -- 29.7%; Untreated -- 29.3%. Injury: 658 slightly injurious. Descending yield order was: (1) Zerlate; (2) Parzate; (3) Zerlate-Tribasic alternating; (4) Tribasic, 658, Dithane Z-78; (5) Zac, 629; (6) Untreated. Cooperator's note: "629 very poor in this experiment."

OHIO (Bowling Green): Descending control order was: (1) Zerlate-Tribasic alternating, Zerlate, and Zerlate-Tribasic dust alternating; (2) Zac; (3) Dithane Z-78; (4) Tribasic dust, Untreated; (5) Tribasic spray. No injury reported. Descending yield order was: (1) Dithane Z-78; (2) Tribasic spray, Zac; (3) Zerlate-Tribasic dust alternating, Zerlate; (4) Tribasic dust, Zerlate-Tribasic spray alternating; (5) Untreated.

Note: The anthracnose data presented below was presented in conjunction with control data on Early Blight, Late Blight, and Septoria diseases. It is presented at this point to give a comprehensive picture of anthracnose control. Yield data will be presented in other places so marked that the yield data can be used in reference to this section.

NEW YORK: Descending order of control was: (1) Zerlate-Zerlate-Bordeaux-Zerlate-Bordeaux -- 3.4%; (2) Zerlate-Zerlate-Tribasic-Zerlate-Tribasic -- 4.8%; (3) Zerlate-Zerlate-Dithane Z-78-Zerlate-Dithane Z-78 -- 5.9%, Zerlate-Zerlate-Dithane Z-78-Zerlate-Dithane Z-78 -- 6.1%, Phygon XL -- 6.7%, Zerlate -- 6.8%, Zerlate-Parzate mixture -- 7.3%; (4) Untreated -- 12.8%; (5) Copper-Zinc-Chromate -- 14.1%

ILLINOIS: Test No. 1. Descending control order was: (1) Manganese ethylene bisdithiocarbamate -- 2.2%; (2) Zerlate-Parzate mixture -- 10.8%, Bioquin 1 plus Wettable Sulfur -- 13.0%; (3) IN-10425 -- 17.8%, Zerlate-Tribasic mixture -- 19.7%; (4) Zac -- 33.7%; Bioquin 1 -- 35.5%; (5) Untreated -- 47.5%, Bioquin 50W -- 48.8%, Tribasic plus zinc -- 50.2%.

Test No. 2. Dithane D-14 -- 5.1%; (2) Parzate -- 11.7%; (3) Dithane Z-78 -- 14.8%, Zerlate-Tribasic alternating -- 15.9%, Zerlate -- 17.5%; (4) Bioquin 1 -- 24.7%; (5) Bordeaux -- 33.7%, Tribasic -- 37.5%; (6) Untreated -- 63%.

OHIO: Descending control order was: (1) Methasan wettable -- 1.7%; (2) Zerlate -- 3.4%; (3) Tribasic A -- 4.2%, Parzate -- 4.3%, Dithane Z-78 -- 4.9%; (4) Tribasic -- 5.5%, Zac -- 5.8%; (5) 658 -- 6.9%; (6) 629 -- 11.3%; (7) Untreated -- 14.3%

PENNSYLVANIA: Descending control order was: (1) Dithane Z-78 -- 3.2%, Zerlate -- 3.3%; (2) Zerlate-Tribasic mixture -- 4.4%, Zac -- 4.6%, Parzate -- 5.2%; (3) Bordeaux -- 8.5%, Manganese ethylene bisdithiocarbamate -- 9.6%; (4) Tribasic -- 12.4%, Tribasic A -- 13.1%, Copper-Zinc-

Chromate -- 14.1%; (5) Untreated -- 28.5%.

DELAWARE: Descending control order was: (1) Bioquin 1 -- 5.1%; (2) Dithane Z-78 -- 6.3%, Zerlate -- 6.4%, Parzate -- 6.9%; Zerlate-Bordeaux split (3-2) schedule -- 7.1%, Zerlate-Parzate mixture (1-1) -- 7.4%; (3) Zerlate-Parzate alternating -- 8.2%, Zerlate-Tribasic alternating -- 9.3%, Bordeaux -- 9.6%; (4) Tribasic -- 12.3%; (5) Untreated -- 27.3%.

LATE BLIGHT

FLORIDA (Indiantown): Descending control order was: (1) Dithane D-14, Parzate; (2) Dithane Z-78; (3) Untreated. No injury noted. Yield in descending order was: (1) Parzate, Dithane D-14; (2) Dithane Z-78; (3) Untreated. Cooperator appended note stating that the Dithane Z-78 was a bad batch having large particle size.

NOVA SCOTIA: All treatments gave perfect control when the Untreated showed 89% infection. Phygon caused yellowing of the foliage late in the season. Descending yield order was: (1) Tribasic, Phygon, Zerlate-Bordeaux split (3-4) schedule; (2) Zerlate-Tribasic split schedule (3-4); (3) Bordeaux 10-7-100; (4) Bordeaux 7-5-100. Two best over-all preferential treatments are Tribasic and Zerlate-Tribasic split schedule.

EARLY BLIGHT

MINNESOTA: Descending control order was: (1) Bordeaux; (2) Parzate, Zerlate, Tribasic, Dithane Z-78; (3) Zerlate-Tribasic alternating; (4) Untreated. Injury: Bordeaux delayed ripening. Descending yield order was: (1) Parzate; (2) Untreated, Tribasic, Zerlate; (3) Dithane Z-78, Zerlate-Tribasic alternating; (4) Bordeaux. Preferred material: Parzate.

NORTH DAKOTA: Descending control order listed was (1) Zerlate, Tribasic; (2) Dithane Z-78; no control data listed for Phygon. Injury: Phygon caused some burning. No significant yield differences -- yields not listed.

CONNECTICUT: Descending control order was: (1) Phygon XL; (2) Zerlate, Dithane Z-78, Zerlate-Parzate alternating; (3) Fermate, Zerlate-Tribasic alternating, Parzate; (4) Untreated, Zerlate-Tribasic split schedule (3-2), Copper-Zinc-Chromate, Dithane D-14; (5) Tribasic, Bordeaux, COCS; (6) Yellow Cuprocide. Injury: Yellow Cuprocide caused some defoliation, and Dithane D-14 caused some bronzing of the foliage. No yield date were taken. Over-all preferential rating: (1) Zerlate, Dithane Z-78, Fermate, Parzate; (2) Phygon XL, Copper-Zinc-Chromate, Dithane D-14, Tribasic; (3) Bordeaux, COCS; (4) Yellow Cuprocide. Cooperator noted that Phygon XL irritated the skin of one operator.

EARLY BLIGHT AND ANTHRACNOSE (Anthracnose data presented above)

NEW YORK: Descending control order was: (1) Zerlate-Zerlate-Bordeaux-Zerlate-Bordeaux, Zerlate-Zerlate-Dithane D-14-Zerlate, Dithane D-14, Zerlate-Zerlate-Tribasic-Zerlate-Tribasic, Zerlate; (2) Zerlate-Parzate mixture; (3) Zerlate-Zerlate-Dithane Z-78-Zerlate-Dithane Z-78, Copper-Zinc-Chromate (658); (4) Phygon; (5) Untreated. Injury: Phygon caused blackening of fruit and Copper-Zinc-Chromate caused marginal leaf scorch. Descending yield order was: (1) Zerlate-Zerlate-Bordeaux-Zerlate-Bordeaux, Zerlate-Parzate mixture; (2) Zerlate-Zerlate-Dithane Z-78-Zerlate-Dithane Z-78, Phygon; (3) Zerlate, Zerlate-Zerlate-Dithane D-14-Zerlate-Dithane D-14; (4) Zerlate-Zerlate-Tribasic-Zerlate-Tribasic, Untreated; (5) Copper-Zinc-Chromate. Over-all preferred material: Zerlate-Zerlate-Bordeaux-Zerlate-Bordeaux.

ILLINOIS: Test No. 1. Descending control order was: (1) Manganese ethylene bisdithiocarbamate, Bioquin 1 plus Wettable Sulfur; (2) Zerlate-Parzate mixture, Zerlate-Tribasic mixture; (3) Bioquin 1; (4) Zac, IN-10425 plus zinc sulfate, Tribasic plus Zinc, Bioquin 50W; (5) Untreated. Injury: Zerlate-Parzate tank mixture caused marginal yellowing. Descending yield order was: (1) Manganese ethylene bisdithiocarbamate; (2) Zerlate-Parzate mixture, Bioquin 1 plus Wettable Sulfur; (3) IN-10425 plus zinc sulfate, Zerlate-Tribasic mixture; (4) Zac, Bioquin 1; (5) Bioquin 50W; (6) Untreated; (7) Tribasic plus zinc. Cooperator's note: "Tribasic plus zinc and Bioquin 50W not worthy of further trials. Zac and IN-10425 plus zinc sulfate not particularly outstanding. Bioquin 1 plus Wettable Sulfur most promising of all tested."

Test No. 2. Descending control order was: (1) Dithane Z-78, Dithane D-14, Parzate; (2) Bioquin 1, Zerlate-Tribasic alternating, Zerlate, Bordeaux; (3) Tribasic; (4) Untreated. Injury: Dithane D-14 and Parzate caused marginal yellowing of leaflets. Descending yield order was: (1) Dithane D-14, Dithane Z-78; (2) Parzate, Zerlate-Tribasic alternating; (3) Zerlate, Bioquin 1; (4) Bordeaux; (5) Tribasic; (6) Untreated. Cooperator's note: "If it can be shown conclusively that Parzate and Dithane Z-78 are equally non-toxic to tomatoes, then both would be given equal ratings throughout. Zerlate appeared to be somewhat poorer in controlling diseases than it has in the past. Bordeaux not worthy of inclusion in future trials for evaluating against early blight and anthracnose."

EARLY BLIGHT, LATE BLIGHT, ANTHRACNOSE (Anthracnose date reported above)

OHIO: Descending control order was: (1) Tribasic; (2) Parzate, 658, Dithane Z-78, Tribasic A, Methasan wettable; (3) Zerlate, Zac; (4) 629; (5) Untreated. Injury: 658 slightly injurious. Descending control order was: (1) Methasan Wettable, Parzate; (2) Tribasic, Tribasic A, Zerlate, Dithane Z-78, Zac; (3) 629, 658; (4) Untreated. Over-all preferred materials: Methasan wettable, Parzate.

PENNSYLVANIA: Descending control order was: (1) Zerlate-Tribasic tank mix; (2) Dithane Z-78, Bordeaux; (3) Tribasic, Tribasic plus zinc, Parzate; (4) Copper-Zinc-Chromate (658), Zac, Liquid Parzate, Zerlate; (5) Untreated. Injury: Parzate caused leaf yellowing; Copper-Zinc-Chromate (658), Tribasic plus Zinc, and Tribasic caused slight stunting; Bordeaux caused stunting. Descending yield order was: (1) Dithane Z-78; (2) Bordeaux, Zerlate-Tribasic tank mix, Tribasic; (3) Tribasic plus Zinc; (4) Parzate, Zac; (5) Liquid Parzate, Copper-Zinc-Chromate; (6) Zerlate; (7) Untreated. Cooperator's note: "Favorable ripening in late September favored Dithane Z-78 and Bordeaux. Dithane Z-78 escaped its usual late blight loss and all Bordeaux-sprayed fruit finally ripened."

EARLY BLIGHT, SEPTORIA, AND ANTHRACNOSE (Anthracnose data reported above)

DELAWARE: Descending control order was: (1) Dithane Z-78, Parzate, Bioquin 1, Bordeaux; (2) Zerlate-Parzate mixture (1-1), Tribasic, Zerlate-Tribasic alternating, Zerlate-Parzate alternating, Zerlate-Bordeaux split (3-3) schedule; (3) Zerlate; (4) Untreated. No injury of consequence observed. Descending yield order was: (1) Zerlate Parzate (1-1), Bioquin 1, Zerlate, Zerlate-Parzate alternating, Dithane Z-78, Parzate; (2) Zerlate-Bordeaux split schedule, Bordeaux, Zerlate-Tribasic alternating, Tribasic; (3) Untreated. Over-all preferred treatments: Dithane Z-78, Parzate. Cooperator's note: "Zerlate did not seem to hold Septoria."

SEPTORIA, EARLY BLIGHT, AND LATE BLIGHT

MARYLAND (Hurlock): Descending control order was: (1) Bordeaux, Tribasic, Dithane Z-78; (2) Bioquin 50W, Dithane D-14; (3) Zerlate plus B1956, IN-10425, Calcium ethylene bisdithiocarbamate, Zerlate, Phygon XL, Zerlate-Tribasic split (3-2) schedule; (4) Untreated. Injury: Parzate and Phygon XL caused yellowing. Descending yield order was: (1) Tribasic; (2) Dithane Z-78, Bordeaux, Dithane D-14, Zerlate-Tribasic alternating; (3) Calcium ethylene bisdithiocarbamate, Bioquin 50W, Zerlate, Zerlate-Tribasic split (3-2) schedule, Zerlate plus B1956. Two preferred materials are Tribasic and Dithane Z-78. Cooperator's note: "Septoria leaf spot was principal disease present. Coppers gave better control of Septoria than organics. Practically no Anthracnose hence Zerlate showed up poorly -- it gave poor control of Septoria."

MARYLAND (Salisbury): Descending control order was: (1) Tribasic; (2) Tribasic dust, Parzate, Dithane D-14, Parzate dust, Zerlate dust; (3) Zerlate; (4) Untreated. No injury observed. Descending yield order was: (1) Tribasic, Zerlate, Tribasic dust, Zerlate dust, Dithane D-14; (2) Parzate; (3) Parzate dust; (4) Untreated. Cooperator's note:

"Early Blight was chief disease early in season during time fungicide applications were made. Septoria and Late Blight appeared late."

LATE BLIGHT AND LEAF MOLD

NORTH CAROLINA: Descending control order for Late Blight fruit infection was: (1) Tribasic dust, Tribasic; (2) Parzate, Parzate dust; (3) Zerlate-Tribasic dusts alternating; (4) Untreated. Descending control order for Leaf Mold was: (1) Tribasic, Tribasic dust; (2) Zerlate-Tribasic dusts alternating, Parzate; (3) Parzate dust; (4) Untreated. No injury noted. Descending yield order was: (1) Tribasic, Tribasic dust; (2) Parzate, Parzate dust; (3) Zerlate-Tribasic dusts alternating; (4) Untreated. Over-all preferred materials: (1) Tribasic spray or dust; (2) Parzate spray or dust.

EARLY BLIGHT AND STEMPHYLIUM

FLORIDA (Bradenton): Descending control order was: (1) Dithane D-14; (2) Liquid Parzate (Na); (3) Liquid Parzate (Ca); (4) Parzate; (5) SR-406, Yellow Cuprocide; (6) Phygon XL; (7) Untreated. No injury noted.

BUCKEYE ROT

TENNESSEE: Descending order of control of fruit infection was: (1) Copper A Compound, Tribasic, Bordeaux; (2) Untreated, COCS, Copper-Zinc-Chromate; (3) Zerlate, Parzate, Dithane D-14. In a dust test the materials used (Copper-Zinc-Chromate, COCS, Yellow Cuprocide, Dithane Z-78) were no better than the Untreated. Copper-Zinc-Chromate spray and dust were the only materials that significantly increased yield over that of the Untreated plants.

ARKANSAS: Descending control order of fruit infection was: (1) Tribasic -- 17.3%; (2) Dithane Z-78 -- 34.8%; (3) Zerlate -- 43.4%; (4) Untreated -- 56.7%. No injury noted. Descending yield order was: (1) Tribasic; (2) Dithane Z-78; (3) Zerlate; (4) Untreated. Over-all preference is as above yield and control order. Cooperator's note: "Excessive rainfall throughout the summer promoted a severe epidemic of Buckeye Rot. Septoria and Alternaria leaf spots were also present and undoubtedly depressed the yield in the case of the check plots. All the fungicides appeared to control these leaf spots."

NO DISEASE OF CONSEQUENCE

FLORIDA (Homestead): Plots abandoned because of mosaic, drought, and salt intrusion. No data presented.

FLORIDA (Indiantown): Stemphylium did not become serious until most of fruits were harvested. There was some nutritional effect present which increased the yield of the sprayed plots over that of the Untreated -- no explanation was offered.

TEXAS (Jacksonville): Test conducted under drought conditions. All the spray and dust materials used, except Stauffer No. 411, increased yield about 10 to 20%. No explanation offered.

IOWA (Ames and Conesville): Yield differences were not significant in both experiments.

WATERMELONS

DOWNY MILDEW

FLORIDA (Leesburg): Dust test. Descending control order was: (1) Dithane Z-78; (2) Copper-Zinc-Lime; (3) COCS. Leaf injury and reduced fruit set reported for Copper-Zinc-Lime and COCS. No yield data reported.

ANTHRACNOSE AND DOWNY MILDEW

FLORIDA (Leesburg): Dust test. Disease of no consequence. Injury data: Copper-Zinc-Lime reduced fruit set and Parzate-Zerlate mixture is suspected of having done so; Dithane Z-78, Zerlate, and Parzate were non-injurious.

NORTH CAROLINA: Dust test. Descending control order was: (1) Zerlate; (2) Parzate, Tribasic-Sulfur; (3) Tribasic; (4) Untreated. Tribasic depressed yields. Diseases appeared late and did not affect yields. Under these conditions, descending order of yield was: (1) Untreated and Zerlate; (2) Tribasic-Sulfur and Parzate; (3) Tribasic. (Tribasic was significantly lower than the Untreated.)

CANTALOUPES

MACROSPORIUM LEAF SPOT

MARYLAND: Some anthracnose was also present in the test plot, but *Macrosporium* was the chief disease. Descending control order was: (1) Bordeaux, Dithane Z-78, Zerlate-Tribasic alternating; (2) Bioquin 50W; Zerlate plus B-1956; (3) Zerlate, Tribasic, Parzate, Phygon XL; (4) Untreated. Zerlate-Tribasic alternating caused stunting and yellowing; Parzate caused yellowing; and Bordeaux caused stunting. Descending yield order was: (1) Dithane Z-78; (2) Zerlate, Untreated, Bioquin, Zerlate plus B-1956; (3) Tribasic; (4) Parzate, Phygon XL, Zerlate-Tribasic alternating; (5) Bordeaux. (Bordeaux, Zerlate-Tribasic alternating, Phygon XL, Parzate, and Tribasic significantly reduced yield.) Over-all preferred fungicides are Dithane Z-78 and Zerlate.

DELAWARE: Spray and dust test. The *Macrosporium* came in late and did not affect yields. Descending order of yield was: (1) Untreated, Tribasic dust, Parzate spray, Dithane Z-78 dust, Fermate dust, Copper A Compound dust, Zerlate dust; (2) Zerlate spray, Parzate dust, Dithane Z-78 spray; (3) Tribasic spray; (4) Copper A Compound spray and Bordeaux spray. (Bordeaux and Copper A Compound sprays significantly reduced the yield; the reduction in yield by Tribasic spray just missed being significant.)

DOWNY MILDEW AND ANTHRACNOSE

NORTH CAROLINA: Dust test. Descending control order was: (1) Dithane Z-78, Zerlate, Parzate, Tribasic; (2) Untreated. Descending yield order (not significant) was: (1) Tribasic and Untreated; (2) Zerlate and Dithane Z-78; (3) Parzate. Over-all preferred material was Tribasic.

ANTHRACNOSE

TENNESSEE: Descending control order for anthracnose fruit rot was: G-4 -- 3.3; Puraturf 177 -- 4.6; Copper A Compound -- 6.5; Untreated -- 11.2. No yield data reported.

NO DISEASE

MICHIGAN: No significant differences in yield.

CUCUMBERS

DOWNY MILDEW AND ANTHRACNOSE

LOUISIANA: Dust test. Anthracnose was light; downy mildew was more severe. Descending order of control for downy mildew was: (1) Zerlate, Fermate, Parzate; (2) Dithane Z-78 and Tribasic; for anthracnose the order was: (1) Dithane Z-78, Fermate, Parzate; (2) Tribasic and Zerlate. Plants treated with Zerlate and Parzate seemed to lack vigor. Descending yield (Bu./A) order was: Dithane Z-78 -- 241; Tribasic -- 231; Zerlate -- 219; Parzate -- 195; Fermate -- 165. Cooperator's note: "Low yield for Fermate was due partly to variation in test field."

DELAWARE (cucumbers for pickles): Downy mildew was the major disease; anthracnose was only present in sufficient amounts for observation. Descending order of control was: (1) Dithane Z-78, Tribasic; (2) Bordeaux, Fermate, Parzate, Zerlate, Copper A Compound, Zerlate-Parzate (1-1); (3) Untreated. Copper A Compound, Bordeaux, and Tribasic caused typical copper injury; Parzate dwarfed the plants. Descending yield order was: (1) Zerlate, Dithane Z-78; (2) Bordeaux, Fermate, Tribasic; (3) Zerlate-Parzate (1-1); (4) Untreated, Parzate; (5) Copper A Compound. Over-all preferred materials: Dithane Z-78 and Zerlate.

The dithiocarbamates controlled anthracnose whereas the coppers did not.

ANTHRACNOSE

OHIO: Dust test. Descending order of control on fruit was: (1) Parzate, Dithane Z-78; (2) Zerlate, Copper A Compound; (3) Tribasic; (4) Fermate, Zac, 629, 658. No injury reported. Descending yield order was: (1) Copper A Compound and Parzate; (2) Zerlate, Tribasic, 658, Dithane Z-78, Fermate; (3) Zac. Over-all preference in descending order: Zerlate, Copper A Compound, Dithane Z-78, Tribasic, Parzate, Fermate, Zac.

BACTERIAL WILT

OHIO: Dust test. Disease not serious. Over-all preference in descending order: Zerlate, 658, Dithane Z-78, Tribasic, Copper A Compound, Parzate, Fermate, Zac.

NO DISEASE

MICHIGAN: Yield in descending order was: (1) Dithane Z-78 and Untreated; (2) Zerlate, Tribasic, Parzate; (3) General Chemical 629 plus 308. Over-all preference in descending order: (1) Dithane Z-78; (2) Zerlate and Tribasic; (3) Parzate. Cooperator's note: "Probably the 629 plus 308 should be dropped; may have caused injury."

CELERY

EARLY BLIGHT (Cercospora)

ONTARIO: Descending control order was: (1) Parzate; (2) Phygon, Zac, Bordeaux, Bordow, Karbam White; (3) 341 C; (4) Untreated. Only injury was slight chlorosis from Zac. No yield data reported.

FLORIDA (Sanford): Descending control order was: (1) Fermate, Tribasic, Copper A Compound, Bordeaux, Zerlate, Karbam White; (2) Parzate, Dithane; (3) Phygon; (4) Untreated. Except for Fermate, the dithiocarbamates caused some bleaching and chlorosis; the copper caused stunting; and Phygon caused leaf and petiole spots. Descending yield order was; (1) Bordeaux, Fermate, Copper A Compound, Tribasic, Karbam; (2) Zerlate, Parzate, Phygon, Dithane; and (3) Untreated. Cooperator's note: "Fermate or Karbam Black produces darker green plants and is first choice. Mixtures or alternating schedules have no advantage over individual treatments. Phygon not worthy of further trial."

FLORIDA (Belle Glade -- late winter and early spring): Descending control order was: (1) Dithane D-14; (2) Dithane D-14-Copper A Compound alternating, and Dithane D-14-Tribasic alternating; (3) Dithane D-14-

Cuprocide alternating; (4) Zerlate and Zerlate-Fermate mixture; (5) Untreated. Only injury was slight chlorosis by Yellow Cuprocide. Descending yield order was correlated with control data. Over-all preferential rating: (1) Dithane D-14 alternating with either Copper A Compound, Tribasic, or Yellow Cuprocide; (2) Dithane D-14 alone; (3)Zerlate; (4) Zerlate-Fermate mixture. Cooperator's note: "Dithane D-14 alone will not give the control of Rhizoctonia that the alternate schedules with copper will. Hence, it is not recommended as a complete celery fungicide. Zerlate and Zerlate-Fermate mixture are not worthy of further trial."

FLORIDA (Belle Glade -- late spring): Descending control order was: Dithane D-14, Parzate, Dithane Z-78; (2) Dithane D-14 alternating with either Copper A Compound or Tribasic; (3) Dithane D-14 alternating with Yellow Cuprocide; (4) Karbam White, Zerlate-Fermate mixture, Karbam White-Karbam Black mixture, HL 275; (5) Zerlate; and (6) Untreated. Descending yield order was: (1) Dithane D-14, Parzate, Dithane Z-78, Dithane D-14 alternating with Yellow Cuprocide, or Copper A Compound, or Tribasic; (2) HL 275, Karbam White, Zerlate, Zerlate-Fermate mixture, KarbamWhite-Karbam Black mixture; (3) Untreated. Over-all preferential rating: (1) Dithane D-14 alternating with Copper A Compound, or Yellow Cuprocide, or Tribasic; (2) Dithane D-14, Parzate, Dithane Z-78. Cooperator's note: "Rhizoctonia was again bad, hence the preference for the D-14-copper schedules. Zerlate, Fermate, the Karbams, and HL 275 will not be used again. Dithane D-14, Parzate, and Dithane Z-78 will not be used except with the copper fungicides."

LATE BLIGHT (Septoria)

BRITISH COLUMBIA: Descending control order was: (1) Fermate liqui-dust; (2) Monocop 26 dry dust; (3) Monocop 26 liqui-dust; (4) Untreated. No yield data reported.

OREGON: Over-all preferential rating was Phygon, Zerlate, and Parzate. Materials used as sprays, dusts, and combined with sulfur were: Phygon, Parzate, Zerlate, and COCS. All materials except COCS gave practically perfect control, and COCS dust gave 95% control whereas as a spray it gave 80% control. No yield data reported. Cooperator's note: "Phygon-Sulfur and Parzate-Sulfur sprays left an unsightly residue. Phygon spray and dust caused some etiolation. COCS not worthy of further testing."

CONNECTICUT: Parzate, Phygon XL, and Dithane Z-78 gave practically perfect control compared to 77% in the Untreated. Phygon XL irritated one operator. No yield data reported.

EARLY AND LATE BLIGHTS

MICHIGAN: Dust test. Descending control order was: (1) Dithane-Sulfur, Dithane, Cuprocide-Sulfur, Tribasic-Sulfur-Zinc; (2) Tribasic-Sulfur; (3) Tribasic. Over-all preferential rating in descending order: (1) Dithane-Sulfur; (2) Cuprocide-Sulfur; (3) Dithane; (4) Tribasic-Sulfur-Zinc. Cooperator's note: "Dithane or coppers combined with sulfur were superior to these materials alone. Adding 'Nu-Zinc' to Tribasic-Sulfur greatly increased efficiency."

ONION

DOWNY MILDEW

BRITISH COLUMBIA: Liqui-Duster Test: Yield (lbs.) in descending order was: (1) Fermate liqui-dust -- 128; (2) E.F.531 -- 99, E.F.169 -- 99; Fermate spray -- 95, Phygon spray -- 90, FMC (70%) spray -- 89, E.F.341 "C" spray -- 88, Karbam White spray -- 88; (3) Bioquin 1 spray -- 77, Perenox spray -- 73, Untreated -- 74. No injury was observed. Spray and Dust Test: Descending control order was: (1) Fermate spray and Perenox spray; (2) Karbam White spray; (3) Fermate dust (10%); (4) Untreated. No injury observed. No yield data presented. Cooperator reported Fermate dust unworthy of further trial.

PURPLE BLOTCH

COLORADO: Two tests reported; applications made 11 to 12 weeks after emergence at 10-day intervals. Spray Test: Over-all preferential rating in descending order was: (1) BCA and Copper A Compound; (2) Dithane D-14; (3) Cuprocide. Cooperator's note: "On the basis of one year's data, Cuprocide, Copper A Compound, BCA, and Dithane D-14 are worthy of further trial. PAS, Bordeaux, Fermate, and Parzate do not justify further use. Application should be made 1 to 2 weeks after emergence." Dust Test: Over-all preferential rating was Copper A Compound, BCA, and Cuprocide. Cooperator's note: "Parzate, Zerlate, and Fermate not worthy of further trial."

LIMA BEANS
(Henderson Bush)

STEM ANTHRACNOSE

NORTH CAROLINA: Descending order of control was: (1) Dithane Z-78 (1.5-100) and Phygon XL (1.5-100); (2) Phygon XL (1.0-100); (3) Fermate (3-100), Phygon XL (0.5-100), Zerlate (1.5-100), and Untreated. No injury except from Phygon XL at 1.5-100. Descending order of yield (Bu. /A) was: (1) Dithane Z-78 -- 355; (2) Phygon XL (0.5-100) -- 317;

Phygon XL (1.0-100) -- 297; Zerlate -- 296; (3) Phygon XL (1.5-100) -- 283; Fermate -- 283; (4) Untreated -- 191. All treatments were significantly better than the Untreated, and Dithane Z-78 was significantly better than all treatments but Phygon XL (0.5-100) as regards yield.

STRING BEANS
(Bountiful)

ANTHRACNOSE

CONNECTICUT: Descending order of control was: (1) Parzate, Fermate, Phygon XL, Dithane Z-78; (2) Untreated. No material caused injury. No yield data presented. Phygon XL irritated the skin of one operator.

CABBAGE

DOWNY MILDEW

FLORIDA (Hastings): Two tests, the first being a spray and dust test on seedlings in the plant bed and the second being a test on heading cabbage.

Plant Bed Test. Descending order of control was: (1) Spergon spray and Spergon dust; (2) Dithane spray and Phygon dust; (3) Parzate dust; (4) Karbam-White spray and Phygon spray; (5) Untreated. Phygon spray caused injury. The descending order of yield was correlated with control.

Heading Cabbage Test. Over-all preferential rating in descending order was: (1) Spergon dust; (2) Dithane D-14 spray; (3) Parzate spray; (4) Copper A Compound dust; (5) Copper A Compound spray; (6) Tribasic spray; (7) Tribasic-Zinc dust; (8) Karbam White dust; (9) Parzate dust; (10) Teresan dust; (11) Fermate dust; (12) Chromate 658 spray; (13) Dithane Z-78 dust; (14) Fermate spray; (15) Untreated; (16) Karbam White spray; (17) Teresan.

ALTERNARIA LEAF SPOT

FLORIDA (Hastings): Descending order of control was: (1) Karbam White, Parzate, Fermate; (2) Spergon and Tersan; (3) Tribasic, Copper A Compound, Chromate 658; (4) Cr. 1639; (5) Phygon. Phygon caused severe injury. No yield data presented. Karbam White, Parzate, and Fermate were listed as the first three preferred materials.

ANTHRACNOSE

NORTH CAROLINA: Descending control order was: (1) Spergon; (2) Dithane Z-78, Zerlate, Fermate; (3) Untreated. Spergon caused slight injury. No yield data presented. Fermate gave an objectionable residue.

USEFULNESS OF SOME OF THE NEWER ORGANIC FUNGICIDES FOR VEGETABLE DISEASE CONTROL

The listing below, based entirely on information contained in this report, is a tentative one. As all materials were not used in all tests, some tests having as few as three materials and others ten or more, it is impossible to accurately compare one material with another. Tables were prepared showing the performance of each material in all tests on each crop as regards disease control, phytotoxicity, and yield. These tables were then used en masse to prepare the listing. Points of major general interest were as follows:

1. The excellent performance of the zinc ethylene bisdithiocarbamates (Dithane D-14, Dithane Z-78, Parzate) on a rather wide range of vegetable crops.

2. The fact that Parzate was phytotoxic when Dithane Z-78 was not, indicating the importance of formulation. (These two materials have the same active ingredient.)

3. The fact that Zerlate apparently failed to control *Septoria* leaf spot on tomatoes and was of doubtful value for the control of *Macrosporium* leaf spot on cantaloupes. This, plus the ineffectiveness of Zerlate for control of late blight of potato and tomato, indicates that Zerlate is restricted in range.

4. When disease was of little or no consequence, the zinc ethylene bisdithiocarbamates did not increase yield.

BIOQUIN 1 and 50W: The high cost of these materials will limit their use. In some tests they did fairly well on tomatoes.

CHROMATE 658: Although it performed quite well, it was not as good as the zinc ethylene bisdithiocarbamates. It was injurious to potatoes and tomatoes.

DITHANE D-14: Outstanding on potatoes and tomatoes, good on celery, and second only to Spergon on cabbage. In some tests it caused slight leaf injury.

DITHANE Z-78: Better than Dithane D-14 on tomatoes and as good on potatoes; the best material on cucurbits; not as effective as some other materials on celery; top material on Henderson lima beans; and on cabbage, equal to Dithane D-14.

FERMATE: Has just about disappeared from use on potatoes and tomatoes and is being replaced by the zinc dithiocarbamates on cucurbits. It does well on celery for early blight control, on onions for downy mildew control, and on cabbage for the control of Alternaria.

G.C. 308: Limited tests show little value.

G.C. 629: Gave the highest yield of potatoes in Michigan. In other States it was of little value on potatoes and tomatoes.

G.C. 629-308: Showed little promise.

KARBAM (BLACK): Similar to Fermate.

KARBAM (WHITE): Similar to Zerlate.

LIQUID PARZATE: Limited tests indicate performance similar to Dithane D-14.

MANGANESE ETHYLENE BISDITHIOCARBAMATE: Performance not as good as that of the zinc ethylene bisdithiocarbamates.

P.E.P.S.: No longer being tested.

PARZATE: Will do everything that Dithane Z-78 will do, but was injurious on cucurbits.

SPERGON: Continues to be the best material for control of downy mildew on cabbage, and in North Carolina it gave the best control Anthracnose on cabbage. It has disappeared from tests on other crops.

ZAC: Not quite as good as the zinc ethylene bisdithiocarbamates.

ZERLATE: Being displaced on potatoes by the zinc ethylene bisdithiocarbamates. On tomatoes, it continues to be the top material for Anthracnose control, but it apparently will not control Septoria; in some tests, it appeared less effective than usual against early blight. It did not control Macrosporium leaf spot on cantaloupes as well as did the zinc ethylene bisdithiocarbamates. The trend seems to be that Zerlate will be superseded by the zinc ethylene bisdithiocarbamates, except for special purposes.

ZERLATE-FIXED COPPER (Alternating Schedule): Did well on tomatoes.

ZERLATE-BORDEAUX (Split Schedule): Appears very good on tomatoes It is anticipated that a zinc ethylene bisdithiocarbamate will be substituted for the Zerlate in time.

ZERLATE-PARZATE (etc.) Tank Mixtures: Appear promising on potatoes and tomatoes. Further tests are needed.

RESULTS WITH ORNAMENTAL CROPS, SHADE TREES AND TURF

Reports were received from 22 cooperators in 15 states. Included were reports on carnation, chrysanthemum, gladiolus, narcissus, rose, snapdragon, turf, and 17 shade trees. Parts of the reports on gladiolus and on narcissus were concerned with cooperative trials in several states.

CARNATION

ALTERNARIA BLIGHT: NEW YORK (Farmingdale): Bioquin 1, Phygon XL, Zerlate, Parzate, and bordeaux 8-8-100 gave good control while Fermate and manganese ethylene bis dithiocarbamate were slightly less effective.

FUSARIUM ROOT ROT AND WILT AND BACTERIAL WILT: COLORADO. Dithane D-14, Dithane Z-78, DuBay 1230 BS, Chloramine, Ceresan M, Arasan, Phygon, Calogreen, Geon Latex 31, and Goodrite Z.A.C. 100% and the four antibiotics penicillin, gliocladicin, aspergillin, and an unknown, were tested as soil drenches against these diseases in greenhouse benches. Dithane Z-78, penicillin, aspergillin, and the unknown antibiotic resulted in a marked reduction in infection. The other materials were relatively ineffective. Dithane D-14 injured the plants.

CHRYSANTHEMUM

SEPTORIA LEAFSPOT: NEW YORK (Farmingdale and Ithaca). Parzate and Dithane D-14 plus zinc sulfate both gave excellent control when used on a weekly schedule. Biweekly applications of these and Dithane Z-78, manganese ethylene bis dithiocarbamate (powder), and IN10425 (liquid) were somewhat less effective. All of the zinc-containing materials caused marginal chlorsis of the older leaves. Fermate, on the basis of previous tests, is still recommended although it was not included in these trials.

GLADIOLUS

LEAF SPOTS (Botrytis, Curvularia, and Stemphylium): FLORIDA. Botrytis and Curvularia were controlled on Snow Princess and Picardy varieties in the following descending order of efficacy: Dithane D-14 plus zinc sulfate, Parzate, Dithane Z-78, Phygon, Zerlate, Puratized Agricultural Spray, Fermate, Cornell silver spray, Glyoxalidine 341 C. Control of Stemphylium was in the same order with but one exception, Puratized gave better control than Zerlate. Phygon caused a stunting of the corms and premature death of the plants. With the exception of the three ethylene bis dithiocarbamate materials, none of the other materials are considered worthy of further trial.

FUSARIUM ROT: COLORADO, FLORIDA, ILLINOIS, MARYLAND, MICHIGAN, NEW YORK, OHIO, SOUTH DAKOTA. The following materials were used on Picardy corms and cormels from one source in a cooperative test: New Improved Ceresan, Ceresan M, Lysol, Arasan, Dow 9B Wettable Seed Protectant, Dowicide B, Puratized Agricultural Spray, Parzate, and mercuric chloride. In general, rot control was best with Dowicide B, followed by New Improved Ceresan, Lysol, and Dow 9B. Arasan was effective in Colorado, Maryland, and New York but not in the other States; Ceresan M was effective in New York; and Puratized Agricultural Spray was generally ineffective. No injury was reported from any of these treatments.

FLORIDA. In additional tests. New Improved Ceresan, Dow 9B, and Ceresan M (1/8 %) gave best rot control, closely followed by Phygon, Spergon, Tersan, and SR-406. Parzate and Fermate gave the poorest control. The first three materials listed delayed emergence; and 1/4 % Ceresan M as a 5 minute dip killed the corms. Phygon caused a dwarfing of the corms.

ILLINOIS. Rot control was in the following descending order: New Improved Ceresan, Dow F-800, Arasan SF, manganese ethylene bis dithiocarbamate, and Puraturf 177. New Improved Ceresan was far superior. Also the standard New Improved Ceresan treatment gave superior rot control in comparison with long soaks in Puratized Agricultural Spray solutions. These long treatments resulted in the production of smaller corms. In one year's trial Dow F-800, Dow 9B, Arasan, Semesan Jr., and Ceresan M, as dusts, gave better control than the standard New Improved Ceresan dip. Phygon, Parzate, and Semesan dusts gave poorer control. Ceresan M and Semesan delayed blooming and stunted the plants.

KANSAS. No rot control was obtained when Parzate, New Improved Ceresan, and Fermate treatments were compared.

NEW YORK (Long Island). Rot control was good with mercuric chloride, and New Improved Ceresan, and fair with General Chemical AG1609B and Dithane D-14 plus zinc sulfate. No control was obtained with Puraturf 177. New Improved Ceresan and mercuric chloride resulted in delayed emergence, and the production of narrow leaves. Puraturf 177 caused a yellowing and twisting of the leaves. Flower and corm yields were best with New Improved Ceresan and mercuric chloride.

SCAB: In the cooperative test mentioned above scab was extremely variable. Mercuric chloride was the only material that reduced scab appreciably but it was effective only in Florida, Illinois, Maryland, Michigan, and Ohio, and not in Colorado, New York, or South Dakota. None of the other materials were effective and the amount of scab was generally greater when Lysol, Arasan, and Dow 9B were used.

SCLEROTINIA DRY ROT: WASHINGTON. Picardy corms were treated with Arasan, Tersan, Ceresan M, Calogreen, Puraturf 177, Dowicide 9B, and Standen #307 before planting. Puraturf 177 gave best control, followed by Arasan and Standen #307. Control was poor with the other materials. Highest yields were obtained with Puraturf 177, Arasan, Standen #307, and Tersan.

NARCISSUS

FUSARIUM BASAL ROT: MARYLAND, NEW YORK, NORTH CAROLINA, WASHINGTON. New Improved Ceresan, 2% Ceresan, Ceresan M, Arasan, Spergon, and Mersolite 8 were compared on narcissus for the control of basal rot in a cooperative test. In general, equally good rot control was obtained with the three Ceresans and with Mersolite 8. Arasan and Spergon gave very good control of rot in North Carolina and Maryland, but poor control in New York where there was a high percentage of infection in the bulb populations used. The three Ceresans all caused flower injury although Ceresan M caused the least. Flower injury was most severe with New Improved Ceresan in North Carolina whereas in Maryland, New York, and Washington 2% Ceresan caused the most flower injury. Considerable reduction in bulb yields occurred when New Improved and 2% Ceresan were used. Best over-all weight of healthy bulbs occurred when Mersolite 8 was used.

MARYLAND. Arasan SF, Dow 9B, Mersolite P, Spergon (Wettable), Puraturf 177, Tersan, bismuth subsalicylate, New Improved Ceresan and Parzate were compared. Rot control was good with the first three of these materials and also with New Improved Ceresan although the latter caused flower injury. Parzate and Puraturf 177 injured the bulbs, which resulted in decreased yields.

ROSE

BLACK SPOT: ARKANSAS. Weekly dust applications of Fermate rose dust, tribasic copper sulfate (1% metallic copper), or sulfur reduced black spot infection in the Etoile de Hollande and Edith Nellie Perkins varieties of roses from 67% in the untreated to 17 to 22% in the treated. Fermate rose dust was slightly better than the other two treatments.

TEXAS: Talisman and Golden Charm roses were not injured by 5 applications of the following dust mixtures; (1) sulfur (90%) +Tennesee Copper 34 (10%); (2) Tennesse Copper 34 (10%) +Dresinate XXX (5%) +sulfur (85%); (3) Dow Rose Dust; (4) Zerlate (7.5%) +sulfur (92.5%); (5) Michigan Chemical Company Rose Dust; (6) Niagara Sprayer R-1856; (7) Parzate (5%) +Fermate (5%); (8)Parzate (10%); (9) Tennesse Copper 34 (10%) +Oil (2%). Condesa de Sastago roses were not injured by 2 applications of the following dust mixtures: (1) DDT (10%) +Copper

(3.4%) +sulfur (86.7%); (2) Toxaphene (10%) +Copper (3.4%) +sulfur (86.7%); (3) Toxaphene (20%) +Copper (3.4%) +sulfur (76.7%); (4) sulfur (90%) +Copper (3.4%) +Chlordane (3%) +DDT (3%). Because of the dry season black spot was not a problem.

SNAPDRAGON

BOTRYTIS BLIGHT: COLORADO. Applications of bordeaux 8-8-100, Cuprocide, Phygon (wettable), Dithane D-14 + zinc sulfate +lime, Zerlate, or Fermate, as sprays, and Cuprocide, Parzate, or Zerlate as dusts were made on snapdragons on a ten-day schedule in greenhouses. Bordeaux and Dithane D-14 gave the best control, followed by Cuprocide (either as a dust or spray), Zerlate (spray), Parzate, Zerlate (dust), Fermate, Dithane Z-78, and Phygon. Control with the last three materials was negligible. Parzate, Dithane Z-78, and Zerlate dusts caused slight blossom burn if the temperature was above 70° F.

RUST: CALIFORNIA, NEW YORK (Ithaca and Farmingdale). Parzate, Dithane D-14 plus zinc sulfate, Dithane Z-78, manganese ethylene bis dithiocarbamate (powder), and IN10425 (liquid) plus zinc sulfate, each combined with Du Pont Spreader-Sticker, were tested on snapdragons. The first two materials were tested on both weekly and biweekly schedules and the last three on biweekly schedules only. Weekly applications of Parzate gave excellent control at all three places and Dithane D-14 was equally as effective in California but slightly less so in New York. Unsatisfactory control was obtained with all of the materials on a biweekly schedule in California and at Ithaca. At Farmingdale good control was obtained with biweekly applications of IN10425, manganese ethylene bis dithiocarbamate, and Dithane D-14, and fair control with Dithane Z-78 and Parzate. Parzate left a conspicuous residue on the foliage.

SHADE TREES

BLACK WALNUT

MARSSONINA LEAF SPOT: ILLINOIS. Puratized Agricultural Spray, Fermate plus lime, bordeaux 8-8-100 plus zinc sulfate, Givauden-Delawanna G-11, and Zerlate were tested. Good control was obtained with Puratized Agricultural Spray and Fermate plus lime, fair control with G-11 and bordeaux plus zinc sulfate, and none was obtained with Zerlate.

SYCAMORE

ANTHRACNOSE: ILLINOIS. Puratized Agricultural Spray reduced anthracnose infection. A number of other materials were used in other plots but the data are unreliable because of the small amount of anthracnose.

FUNGICIDE INJURY TO SHADE TREE FOLIAGE: ILLINOIS. A number of shade trees were sprayed with different fungicides and, while leafspot diseases were insufficient to provide disease control data, observations were made on phytotoxicity. Puratized Agricultural Spray caused slight brown spotting on the under surface of sycamore leaves; G-4 caused slight leaf burn on catalpa and hard maple and a slight bronzing of the lower leaves of black walnut; G-11 caused a slight leaf burn on Norway maple and a slight yellowing and a leaf drop on black walnut; Fermate plus lime produced a slight blackening on the under side of black walnut leaflets; cuprous oxide and manganese ethylene bis dithiocarbamate each burned the margins of black walnut leaves; 341-C, 658, and Parzate caused a slight bronzing of some of the lower leaves of black walnut; and Puraturf 177 caused abundant yellowing and premature leaf drop on Ulmus parvifolia. No injury was observed on trees sprayed as follows: Bordeaux 8-8-100 plus zinc sulfate on American elm, black walnut, white oak; Puratized Agricultural Spray on American elm, black walnut, Norway maple, hard maple, white ash, catalpa, white oak, hackberry; G-4 on American elm, Ulmus parvifolia, Norway maple, white ash, hackberry; G-11 on American elm, Ulmus parvifolia, U. pumila, black walnut, English elm, linden, mountain ash, white oak; Fermate and lime on American elm, Ulmus parvifolia, white oak; Zerlate on American elm, Ulmus pumila, black walnut; Dithane Z-78 on American elm, U. parvifolia; special cuprous oxide on American elm, Ulmus pumila, U. parvifolia, English elm, sycamore, Norway maple, hard maple, linden, mountain ash, white ash, catalpa, red oak, white oak, hackberry, soft maple; 341-A on American elm, U. parvifolia; 341-C on American elm, Ulmus pumila, U. parvifolia, English elm, sycamore, Norway maple, hard maple, linden, mountain ash, American white birch, catalpa, red oak, soft maple; 531 on American elm, Ulmus parvifolia; 658 on American elm, Ulmus pumila, U. parvifolia, English elm, Norway maple, hard maple; Z.A.C. on American elm, Ulmus parvifolia, U. pumila, English elm, sycamore, black walnut, Norway maple, hard maple, American white birch, white ash, red oak, white oak, soft maple; Parzate or manganese ethylene bis dithiocarbamate on American elm, Ulmus parvifolia, U. pumila, English elm, black walnut, sycamore, Norway maple, hard maple, linden, mountain ash, American white birch, white ash, catalpa, red oak, hackberry, soft maple; Puraturf 177 on American elm, black walnut, sycamore, or catalpa.

TURF

(Bent Grasses)

LARGE BROWN PATCH: RHODE ISLAND. In one test Calochlor was most effective, followed by Puraturf 177 and GG. Cd C was not effective and

Cd A and Cd B resulted in an increase in the affected area. In another test Spergon W, Tersan, and Phygon gave complete control; Special Semesan, H258D, Calochlor, and Puraturf 177, good control; and 7 R 2312 gave some control. Calochlor caused some injury.

DOLLARSPOT: RHODE ISLAND. In one test Puraturf 177, GG, and Cd B gave excellent control; Cd C, good control; and Cd A and Calochlor, fair control. In another test 7 R 2312 and Puraturf 177 gave good control, and H258D and Calochlor poor control. Spergon W, Tersan, Phygon, and Special Semesan were not effective.

EFFECTIVENESS OF SOME OF THE NEWER MATERIALS ON TURF, ORNAMENTALS, AND SHADE TREES

ARASAN. Gives good control of gladiolus dry rot and appears to be promising in some areas for the control of *Fusarium* rot, although it seems to increase the amount of scab. It is fairly effective against narcissus basal rot in some areas.

BIOQUIN 1. Effective against *Alternaria* blight of carnations.

CERESAN M. This is as effective as New Improved Ceresan or 2% Ceresan for basal rot of narcissus but is much less injurious. It should be given further trials for *Fusarium* on gladiolus although it gives poor control of gladiolus dry rot.

DITHANE D-14. Has given good results with *Septoria* leaf spot of chrysanthemum, gladiolus leaf spots, and snapdragon rust.

DITHANE Z-78. Effective for gladiolus leaf spots and shows promise as a soil drench for the control of soil-borne diseases of carnations.

DOW 9B. Looks good for gladiolus *Fusarium* either as a dip or as a dust, also merits further trial for the control of basal rot of narcissus.

DOW F-800. Deserves further trial for the control of gladiolus *Fusarium*, particularly when used as a dust treatment.

DOWICIDE B. Has given good *Fusarium* rot control in gladiolus.

FERMATE. This is very effective for *Septoria* leaf spot of chrysanthemum but has not been effective against *Fusarium* rot and the leaf spots of gladiolus.

GLYOXALIDINE 341-C. Was not effective against gladiolus leaf spots and causes some injury on black walnut.

MANGANESE ETHYLENE BIS DITHIOCARBAMATE. Looks promising for *Alternaria* blight of carnations, and *Septoria* leaf spot of chrysanthemums. It burned the margins of black walnut leaves.

MERSOLITE. Mersolite 8 has been very effective against narcissus basal rot and does not cause the flower injury that frequently results from treatment with the Ceresans. Mersolite P as a dust merits further trial as a control for the basal rot of narcissus.

PARZATE. This has been very effective for *Alternaria* blight of carnations, *Septoria* leaf spot on chrysanthemums, gladiolus leaf spots, and snapdragon rust. It has given poor control of *Fusarium* rot in gladiolus and has injured narcissus bulbs.

PHYGON: This has been effective for brown patch of turf but ineffective against dollarspot. It was injurious when used as a spray on gladiolus. Phygon XL has been effective against *Alternaria* blight of carnations.

PURATIZED AGRICULTURAL SPRAY. Was effective against leaf spot on black walnut but injured sycamore leaves. Small corms were produced following prolonged soaks of gladiolus corms in solutions of this material. It was ineffective against *Fusarium* and leaf spots in gladiolus.

PURATURF 177. This was effective against large brown patch and dollarspot of turf and dry rot of gladiolus, but was not effective against the gladiolus *Fusarium*. It injured gladiolus, narcissus, and leaves of *Ulmus parvifolia*.

SPERGON W. This was effective in controlling the large brown patch of turf but was ineffective against dollarspot.

ZERLATE. This was effective against *Alternaria* blight of carnations but was ineffective against leaf spots of gladiolus and leaf spot of black walnut.

RESULTS WITH MISCELLANEOUS DISEASES

TOBACCO

BLUE MOLD:

GEORGIA; SOUTH CAROLINA; NORTH CAROLINA; VIRGINIA; MARYLAND AND CONNECTICUT: All reported good control with Fermate spray (2 to 4 - 100) and dust (15%). Karbam (black) was also tested and found satisfactory at a number of locations. Dithana Z-78 spray (2 to 3 - 100) and dust (10%) was also effective. Parzate gave good control but caused slight injury at rates that were somewhat excessive. Virginia reported outstanding control of anthracnose with Parzate. Connecticut reported that Oxyquinoline benzoate (1-100) and Phygon (2-100) gave good blue mold control but caused serious plant injury.

HOP

DOWNY MILDEW:

CALIFORNIA: Dithane Z-78 (2-100), basic copper sulphate (6-100) and Spergon (4-100) all gave excellent control.

RESULTS WITH SOIL STERILIZATION AND FUMIGATION

CARROT

ROOT KNOT:

NEW YORK: Tests were conducted both on muck and upland farms. DD and Dowfume W10 (20 - 30 gallons per acre) increased yields of bunched carrots from 37-50% to 73-92%. Greenhouse tests indicated that on the basis of effectiveness per unit of cost, ethylene dibromide is the most powerful nematicide, followed in descending order by DD, methyl bromide and chloropicrin. DD, methyl bromide and ethylene dibromide mixtures penetrate fresh solid galls in 2 to 4 hours. Chloropicrin penetrates galls effectively only after they are decayed. On the basis of residual phytotoxicity, the rating was chloropicrin (most), DD, and methyl bromide (least).

CUCUMBER

ROOT KNOT:

SOUTH CAROLINA: Broadcast treatments with DD and Dowfume W40 (20 g.p.a.) were compared with row treatments of the same materials (6.7 g. p. a.). Yield increases ranged from 23 to 53%. Broadcast treatments were superior to row treatments and DD gave larger increases than W40.

GREEN BEANS

ROOT KNOT:

NORTH CAROLINA: Soil applications were made in the fall and spring with DD, Dowfume W40, and chloropicrin at 20, 40, and 60 g.p.a. All treatments gave effective root knot control. Chloropicrin and DD at 60 g.p.a. in the fall, and the same materials at 40 and 60 g.p.a. applied in the spring, caused plant injury and reduced yields.

PEA

ROOT KNOT:

FLORIDA: DD and Soilfume 80-20 (23 g.p.a.) were applied 2 weeks before seed sowing. DD caused severe injury to the pea crop while the ethylene dibromide mixture did not.

TOMATO

ROOT KNOT:

FLORIDA: Row fumigation with DD and Dowfume W40 (9g.p.a.) gave respectively 85 and 35% control of root knot.

TOBACCO

ROOT KNOT AND MEADOW NEMATODE:

FLORIDA (Gainesville): DD at 20 g.p.a. broadcast, and Dowfume W40 at 15 g.p.a. increased yields of flue-cured tobacco by 437 and 562 pounds of cured leaf per acre. Disease conditions were extremely severe and by the end of the crop season infestation was again general in all plots.

(Quincy): Experiments with shade tobacco showed that DD (20-23 g.p.a.) and W40 (14-16 g.p.a.) applications made early in September were more effective than applications in December. Early February treatments were still less effective. Increases in yields were 12 to 16% and the results with DD and W40 were about equal.

GEORGIA: Dowfume W40 and DD were compared using row treatments of 5, 10, and 15 g.p.a. and broadcast treatments of 15 and 20 g.p.a. Nematode infection was very heavy and the average yield for untreated checks was only 672 pounds with returns of $287 per acre. Row treatment at 5 g.p.a. increased yields to 1642 pounds (mean of 4 plots) and value to $867 per acre. The highest rate of treatment, 20 g.p.a. gave an average yield of 1662 pounds per acre and a crop value of $862. Thus under the conditions of this experiment the differences between treatment rates were negligible. Also there was no significant difference between the results secured with DD and W40. The tobacco for the treated plots averaged $52 to $53 per 100 pounds, that for the check plots $41. In other tests there were no differences between row applications made in a single stream or in 2 parallel streams.

SOUTH CAROLINA: Row treatments with DD and Dowfume W40 at 5, 10, and 15 g.p.a. and broadcast treatments at 20 and 30 g.p.a. were compared. All treatments gave increased yields of cured leaf -- the increases ranging from 125 to 411 pounds per acre. Corresponding increases in acre value were $90 to $271 per acre. In this experiment the gains in yield and crop value were in proportion to the amounts of fumigant applied. Unit for unit W40 gave somewhat better nematode control than DD but there was no difference between the two in yield or crop value increases. Tobacco from the treated plots sold for 3 to 9 dollars per

100 pounds more than that from the untreated checks.

SUGAR BEET

NEMATODE:

UTAH: Dowfume N and DD (25 g.p.a.) were applied broadcast. Yield increases of 225% were secured at one location and of 92 and 100% at another. Wireworm control was also a factor in the results secured.

COTTON

FUSARIUM WILT:

ALABAMA: DD and Iscobrome D were compared in row application at 3.5, 7 and 14 g.p.a. The 3.5 rate of DD controlled the wilt and increased the yield of lint cotton by 45%. This rate appeared to be most economical when used in connection with a resistant variety. Approximately 10 g.p.a. of Iscobrome D was required for comparable results. Applied at seeding time DD caused crop injury while Iscobrome D did not.

MISCELLANEOUS NOTES

DAMPING-OFF (PYTHIUM):

NEW YORK: In tight containers, 25 cc of Dowfume G per cubic foot for 3 to 6 hours gave good control.

TESTS WITH NEW ORGANIC INSECTICIDES

SOUTH CAROLINA: Isotox 5 pounds per acre in the fertilizer had no effect on yield (cucumber).

NORTH CAROLINA: Benzene hexachloride (6% g.i.), DDT (50%), Parathion (25%), Chlordane (50%), and Chlorinated Camphene were tested in soil applications against root knot. None showed any nematicidal value.

Similar negative findings have been reported by Mr. Norman Allen at the Pee Dee Experiment Station, South Carolina.

GEORGIA: DD and ethylene dibromide soil treatments have consistently controlled southern stem rot (_S. rolfsii_) on tobacco. They have also given partial control of _Fusarium_ wilt (_F. oxysporum_ var. _nicotianae_)

SOUTH CAROLINA: The above fumigants gave no control of the sore shin disease of tobacco caused by _Rhizoctonia solani_.

CONCLUSION

In conclusion we may note as very suggestive the outstanding results obtained at several locations with low rates -- 3.5 and 5 g.p.a. -- and the indication that temporary reduction in numbers of nematodes -- not elimination -- is the profitable objective. Progress would be facilitated by the development of a simple accurate, inexpensive, row application drill. Though the results are not entirely conclusive it appears that medium and low rate fumigant treatments may be safely applied as little as 10 days before seed sowing and 12 days before plant setting. Ethylene dibromide mixtures are eliminated from the soil more rapidly then the propene-propane type.

RESULTS FROM SEED TREATMENT TESTS

Forms for reporting results from seed-treatment tests were sent to 45 workers in 26 States and 4 Canadian Provinces. Reports were received from 30 individuals or cooperating groups in 21 States and 3 Provinces. Replies from nine workers stated that no results were available. The relative meagerness of data on seed treatments suggests a tendency on the part of many investigators to abandon this type of work after the intensive wide-spread activity in this field during and immediately after the late war. The appearance of new fungicides on the market, however, and changes in materials previously tested, make it desirable that such tests be continued.

Twenty-two commercial fungicides and 18 experimental materials were reported as having been tested on seed of one or more of 26 crops. These reports are summarized in table 1.

BARLEY

In Ontario *Helminthosporium sativum* infection was controlled by Panogen with 56% in the check. In Manitoba, Panogen and the Ceresans controlled a light infection of covered smut. In Saskatchewan, Panogen controlled covered smut (7%) and improved emergence.

OATS

In somewhat extensive greenhouse and field experiments in Ontario, N. I. Ceresan, Panogen and R118A were outstanding in the control of seed-borne *Helminthosporium victoriae*. With 15.5% infection in the checks, oat smut was eliminated in one experiment by R-118 A and Arasan, and reduced to less than 0.5% by seven other materials, four of which along with Arasan are not usually found effective in controlling smut in naturally infected seed. In Kansas, in experiments in 36 counties seed treatment with the Ceresans resulted in a 20 % increase in yield from seed of varieties susceptible to Victoria blight but did not increase yields from seed of resistant varieties. The Ceresans also controlled oat smut, but Arasan, Spergon and Phygon were found unsatisfactory for teating oat seed. Similar results on oat smut control were reported from North Carolina.

WHEAT

Reports from Kansas and three Canadian Provinces indicate that in general Ceresan M and N. I. Ceresan continue to be the preferred treat-

Table 1. Summary of Seed Treatment Reports for 1948

Crop	Reports received	Materials tried	States and Provinces represented	Best results obtained from
	number	number		
Barley	3	10	Man., Ont., Sask.	N.I. Ceresan, Ceresan M, Panogen
Oats	4	15	Ont., Sask., Kans., N. Car.	N.I. Ceresan, Ceresan M, R118A Panogen, Leytosan
Wheat	4	13	Ont., Man., Sask., Kans.	N.I. Ceresan, Ceresan M, Phygon, Arasan, Spergon, Panogen
Rice	4	8	Tex., Ark., La., Calif.	Yellow Cuprocide, Arasan, Ceresan M, Phygon, Spergon
Sorghum	2	9	Calif., Md., Nebr.	Phygon XL, Arasan, Spergon, Ceresan M, Panogen
Corn	4	8	Wisc., Ill., Nebr., Ia	Arasan, Phygon, Spergon
Flax	2	10	Man., Ont.	Ceresan M, N.I. Ceresan
Cotton	2[a]	4	N. Car., S. Car., and other States	Ceresan M, Dow 9 B, Seedox, Dow F-800
Sugar-beets	3[a]	8	Ten States and Manitoba	Phygon, N.I. Ceresan, Ceresan M, Arasan
Peanuts	2	8	Ala., S. Car.	Arasan, Phygon, Dow 9B, Spergon
Soybeans	1	2	N. Car.	Arasan
Peas	5	24	Ont., Ida., S. Car., Miss., Pa.	Arasan, Spergon, Phygon, Tribasic, C. & C., Zerlate
Beans	4	16	Colo., Miss., Ida., S. Car.	Arasan, Spergon, Dithane Z-78, Phygon
Potatoes	1	10	Nebr.	Arasan, Dithane dip
Onion	2	5	Mich., Ia.	Arasan, Dithane Z-78, formaldehyde
Tomato	2	9	S. Car., Pa.	Arasan, Cuprocide, Phygon
Misc. Veg.	1	8	S. Car.	Phygon, Ceresan M, Arasan, Spergon

[a] One report summarizes results of widespread cooperative tests.

ments for wheat for general disease control. Several other materials, however, have at times proved equal to these in controlling bunt and improving emergence; among these are Phygon, Arasan, Spergon, Panogen, Leytosan and Lunasan. The choice of materials in such cases will be governed by price, availability, and ease of application.

RICE

Results from four States differed because of differences in environment, methods and rates of application, interval between treating and sowing, methods of seeding, and varieties used. Arasan, Ceresan M, and Yellow Cuprocide were rated first most frequently but Phygon, Spergon, and Dow 9 B also rated well in improving emergence and controlling seedling blight. Increases in emergence, however, were not always reflected in increased yields. In general, all rice treatments are applied by the slurry method.

SORGHUM

Sorghum seed is treated largely to control covered kernel smut and to improve emergence by controlling seedling blight. Reports from 3 States indicate that Phygon XL, Arasan, and Spergon are the most effective in improving stands but that the mercurials, Ceresan M (dust or slurry), N. I. Ceresan, and Panogen, are superior in smut control especially in varieties whose seeds have persistent glumes. Care must be exercised in using mercury treatments, as a too heavy application or prolonged storage after treatment may result in abnormal sprouting. Varieties differ in this sensitivity to mercury treatments.

CORN

Reports from 4 States indicate that Arasan, Phygon and Spergon are the leading fungicides for treating seed corn. In general practice they are applied as a slurry, but they are equally effective as dusts. At 3 locations in Nebraska, although emergence from treated seed was very slightly better than from untreated seed, the yield was about 3% less.

Reports from Illinois, Iowa, and Wisconsin seem to rule out Panogen as a treatment for corn. The older treatment materials: Merko, Barbak C and Semesan Jr., are no longer on the market.

FLAX

N. I. Ceresan or Ceresan M at 1.5 ounces per bushel is the only recommendation received. In Royal Flax, Panogen applied at the rate of 4-1/2 fluid ounces per bushel reduced infection by Alternaria linicola in a plate test to 27.5% compared with 45% in untreated seed. However, many seedlings showed injury from overtreatment.

COTTON

Experiments with Ceresan M, Dow 9B, Dow F-800 and Seedox were carried out at 13 stations. Ceresan M was slightly superior, and Dow-F-800 was inferior to Dow 9B and Seedox. All were applied at 3 grams per kilogram of seed. Dow 9B and Seedox have the advantage of being non-poisonous to livestock.

SUGAR BEETS

An extensive cooperative seed-treatment project was carried out in 1948 involving 24 cooperators at 22 locations in 10 States and one Canadian Province. The seed used was U. S. 215 x 216. It was processed and treated at Rocky Ford, Colorado and sent to the different cooperators for uniform planting.

Phygon, N. I. Ceresan and Ceresan M, Arasan, and copper trichlorphenate were effective in improving emergence and stand in the order named. Seed treatments resulted in significantly better stands at 13 of the 22 locations; Phygon and Ceresan M each caused significant increases in 11 of these tests, N. I. Ceresan in 10, Arasan in 6 and copper trichlorphenate in only 4. In 9 locations none of the treatments caused significant increases.

Phygon showed no indications of injury to germination, even in treated seed that had been stored for 3 years. N. I. Ceresan showed some injury to germination in seed that had been stored under humid conditions. Similar data on the effects of Ceresan M are not yet available.

Four lots of pelleted seed were compared with seed that was not pelleted and either left untreated or treated with N. I. Ceresan. Nine of the 22 tests gave significant differences in stand. Treatment with N. I. Ceresan resulted in significant increases in 6 tests; pelleted seed with 5% by weight of Arasan in 8 tests; pelleted seed with 10% of Arasan and 2% treble super-phosphate gave significant increases in 5 tests; pelleted seed containing no fungicide or fertilizer was superior to untreated seed in only one test and inferior in 5 tests. In general, seed treated with N. I. Ceresan, gave results comparable to the best pellets.

In California, in experiments with European seed heavily infected with Phoma betae, the only effective treatments were the organic mercurials such as ethyl mercury phosphate spray (.0125% solution), a 20 minute dip in a 1 to 24000 solution, or a spray with Ceresan M (0.25% in water). Nitroso-Pyrazole and Phygon XL were effective against damping off by Pythium ultimum.

PEANUTS

In Alabama, Arasan, Phygon, Dow 9 B, or Spergon, all at 2 or 3 ounces per 100 lbs. of seed, were rated best for combating seedling blight. Ceresan M at a relatively heavy dosage reduced germination. In South Carolina, Seedox, Ceresan M, Arasan, Phygon and Spergon, and Dow 9 B, Cuprocide, and Semesan in the order named improved emergence.

PEAS

In Ontario, Bioquin 75, Phygon, and Dow F-800, at 2, 3 and 2 ounces per bushel respectively, gave the best control of *Ascochyta* spp. in Thos. Laxton peas, while Zerlate (1-1/2 oz.) Phygon and Spergon (3 oz.) produced the best yields. In Idaho, Phygon, Arasan, and Spergon were rated best for seed decay and damping-off in this same variety. In Pennsylvania, Carbon and Carbide "A", tribasic copper sulfate, Spergon, and Arasan were rated in that order in the control of damping-off in Laxton Progress peas. In Mississippi, the order of effectiveness in increasing yields was: Spergon, Fermate, Ceresan M., Phygon, and Arasan S. F. In South Carolina, Phygon XL, Semesan, Arasan, Ceresan M, Spergon, Dow 9 B, and Seedox all gave highly significant increases in emergence.

BEANS

In Idaho, Phygon, Arasan, and Spergon (dust or slurry) are recommended for seed decay and damping-off in garden and field beans. Ceresan M injured the seed. In extensive trials in Mississippi, Arasan and Spergon seemed most consistent in improving emergence and at the same time increasing yields. Ceresan M, 2% Ceresan, Semesan, and Puratized 177 were at times beneficial to emergence and stand. Phygon was not included. In Colorado, *Fusarium* root rot on Pinto bean responded slightly more to Dithane 78, crude Penicillin, and Ceresan M than to the materials more commonly used.

POTATOES

In one report from Nebraska, Arasan dust, Dithane D-14 dip, Dithane Z-78 dust, Fermate, and B-K dip, in the order named, were effective in preventing seed piece decay in Red Warba potatoes. Spergon, Emulsept dip, zinc oxide, and Kopper King were ineffective.

ONIONS

In onion-smut experiments in Michigan, the best control, stands, and yields were obtained with Dithane Z-78 and Arasan diluted, 1 to 3 with talc and applied in the rows at 8 pounds per acre. In Iowa, formaldehyde (1 to 75) applied at 115 gallons per acre was best in onion smut control, with Arasan second, while Dithane Z-78 and Arasan produced the best stands.

OTHER CROPS

In North Carolina, in one experiment with soybeans, Arasan was far superior to Dow F-800 in its effect on emergence. In Pennsylvania, Arasan and tribasic copper sulphate were best in controlling damping-off in tomatoes; Carbon and carbide were also good while Cuprocide caused stunting.

In South Carolina in germination and stand tests with seeds of a number of crops, the materials ranking first, second, and third respectively, for the different crops were:

Spinach: Cuprocide, Spergon, Phygon XL;
Carrot: Cuprocide, Arasan, Ceresan M;
Lettuce: Arasan, Ceresan M, Cuprocide;
Tomato: Cuprocide, Arasan, Phygon XL;
Beet: Phygon XL, Cuprocide, Ceresan M;
Paprika: Ceresan M, Cuprocide, Seedox;
Sweet corn: Arasan, Spergon, Phygon XL;
Snap bean: Ceresan M, Cuprocide, Semesan;
Kidney bean: Ceresan M, Phygon, (no close third);
Cucumber: Phygon XL, Ceresan M, Semesan;
Musk melon: Phygon XL, Seedox, Ceresan M;
Watermelon: Phygon XL, Spergon, Seedox;
Okra: Spergon, Phygon XL, Ceresan M;
Dow 9B caused significant increases in some cases.

GENERAL APPRAISAL OF FUNGICIDES FOR SEED TREATMENT

ARASAN: For seeds of corn, flax, peanut, sorghum, soybean and other forage crops, sugar beet, and most vegetables. Controls bunt in wheat but is not recommended for diseases of barley and oats.

CERESAN M: For seed of barley, oats, wheat, flax, sorghum, rice, cotton, sugar beet, and certain vegetables.

N. I. CERESAN: For seed of barley, oats, wheat, flax and sugar beet.

CUPROCIDE: For seed of rice, peanut, and most vegetables except cabbage and cucumber.

DITHANE: D-14 and Z-78: Both were effective for seed-piece decay in potatoes while Z-78 prevented smut in onions and *Fusarium* root-rot in beans; neither was extensively tested.

DOW 9-B: For seed of cotton, peanut, pea, rice and some vegetables.

DOW F-800: Used on seed of cotton, oats, pea, and some other crops but usually was inferior to other materials. It failed to control oat smut.

FORMALDEHYDE: Still the most effective for preventing onion smut.

LEYTOSAN: Used on seed of cereals in Canada but was generally inferior to the Ceresans in cereal disease control.

PANOGEN: For seed of barley, oats, wheat, and sorghum but unsuitable for corn. This material is a recent introduction from Sweden where it has been approved for seed of cereals and sugar beet. It should be more widely tested.

PHYGON XL: For seed of corn, rice, sorghum, wheat, sugar beet, peanut, pea, bean, and most vegetables.

SEEDOX: Promising for cotton seed but needs more testing.

SPERGON: For seed of corn, rice, sorghum, wheat, peanut, pea, bean, and most vegetables. Controls bunt in wheat but is not recommended for seed of barley and oats.

OTHER MATERIALS: R118-A was promising on seed of oats in Canada; Lunasan, phenyl mercury acetate, and Agrosan 9N showed some promise on wheat; copper carbonate controlled bunt as usual; a number of other materials were insufficiently tested to evaluate their effectiveness.

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SUPPLEMENT 182

FUNGICIDAL AND PHYTOTOXIC PROPERTIES OF 506 SYNTHETIC ORGANIC COMPOUNDS

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

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FUNGICIDAL AND PHYTOTOXIC PROPERTIES OF 506 SYNTHETIC ORGANIC COMPOUNDS[1]

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For a number of years the Division of Insecticide Investigations of the Bureau of Entomology and Plant Quarantine has been preparing synthetic organic compounds for studies of their insecticidal properties. Since 1938 the Bureau of Plant Industry, Soils, and Agricultural Engineering has cooperated in the preliminary testing of many of these compounds for their fungicidal properties. The studies presented in this paper represent the results of such tests made during the years 1938 to 1946. The primary object of these studies was to discover synthetic organic chemical compounds that could be used in a practical manner in orchards and in field plots. It was hoped that compounds would be found that were noninjurious to the host plants and could be substituted for the more injurious and commonly used sulfur and copper fungicides. These studies have not taken into account the possibilities of the compounds when used to combat soil- and seed-borne fungus parasites, organisms that destroy stored food, or organisms that cause deterioration of fabrics and lumber; and they have not indicated to what extent the materials may be useful as bactericides, hormones, or weed killers.

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[1] The Plant Disease Survey recognizes that the material presented in this Supplement differs from the usual content of the Plant Disease Reporter, and may not be of direct interest to many of its readers. It is issued as a special contribution because of its fundamental importance. The Survey does not assume responsibility for the subject matter. The expense of publication is borne by the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering. P.R.M.

MATERIALS AND METHODS

Most of the compounds discussed in this report are solids practically insoluble in water. These materials were selected because fungicides, in order to be effective under field and orchard conditions, must remain on the plants from one spray application to the next. This period varies for different crop plants from one to several weeks. Generally speaking, water-soluble materials deposit thin layers of toxicant, which are removed easily from plant surfaces by rain. Such water-soluble chemicals are useful as eradicators against a limited number of organisms. For a chemical to be considered as a protective fungicide it must be slowly soluble and non-injurious to the host plants, and it must remain as a residue on the plant surface for at least 10 to 14 days.

The methods developed for screening compounds as fungicides are based upon the foregoing requirements. The steps taken in the determination of fungicidal and phytotoxic properties of a compound are shown in the diagram opposite (Figure 1).

In all tests the material, after being properly ground, was suspended in water. If a wetting agent was needed, several drops of a solution of one-half ounce of an alkyl aryl sulfonate (Santomerse S) in 100 gallons of water were used.

The formulations varied with the period when the tests were conducted. When the tests were begun, in 1938, the newer synthetic insecticides were not in use. It was then necessary to consider the compatibility of the compounds with the adjuvants ordinarily used when lead arsenate was employed as the insecticide. Because of this, lime[2] or lime plus bentonite was frequently added to the compound tested. When the synthetic organic insecticides came into use, this step was not necessary. A grinding agent, such as pyrophyllite, was frequently added to help suspend the compounds.

After the compound to be tested was properly suspended in water, it was used as a spray on plants and also for the preparation of deposits simulating spray residues on leaves. These residues were to be used in testing their toxicity to the conidia of the fungi that cause peach brown rot (*Monilinia fructicola* (Wint.) Honey) and apple bitter rot (*Glomerella cingulata* (Ston.) Spauld. and Schrenk).

The spraying of the plants (peach) was done with a hand-operated spray gun or a paint gun connected with a portable air compressor. The small limbs or small plants were completely covered with the spray. The pressure never exceeded 40 pounds per square inch; so none of the plants were mechanically injured.

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[2] Hydrated lime used.

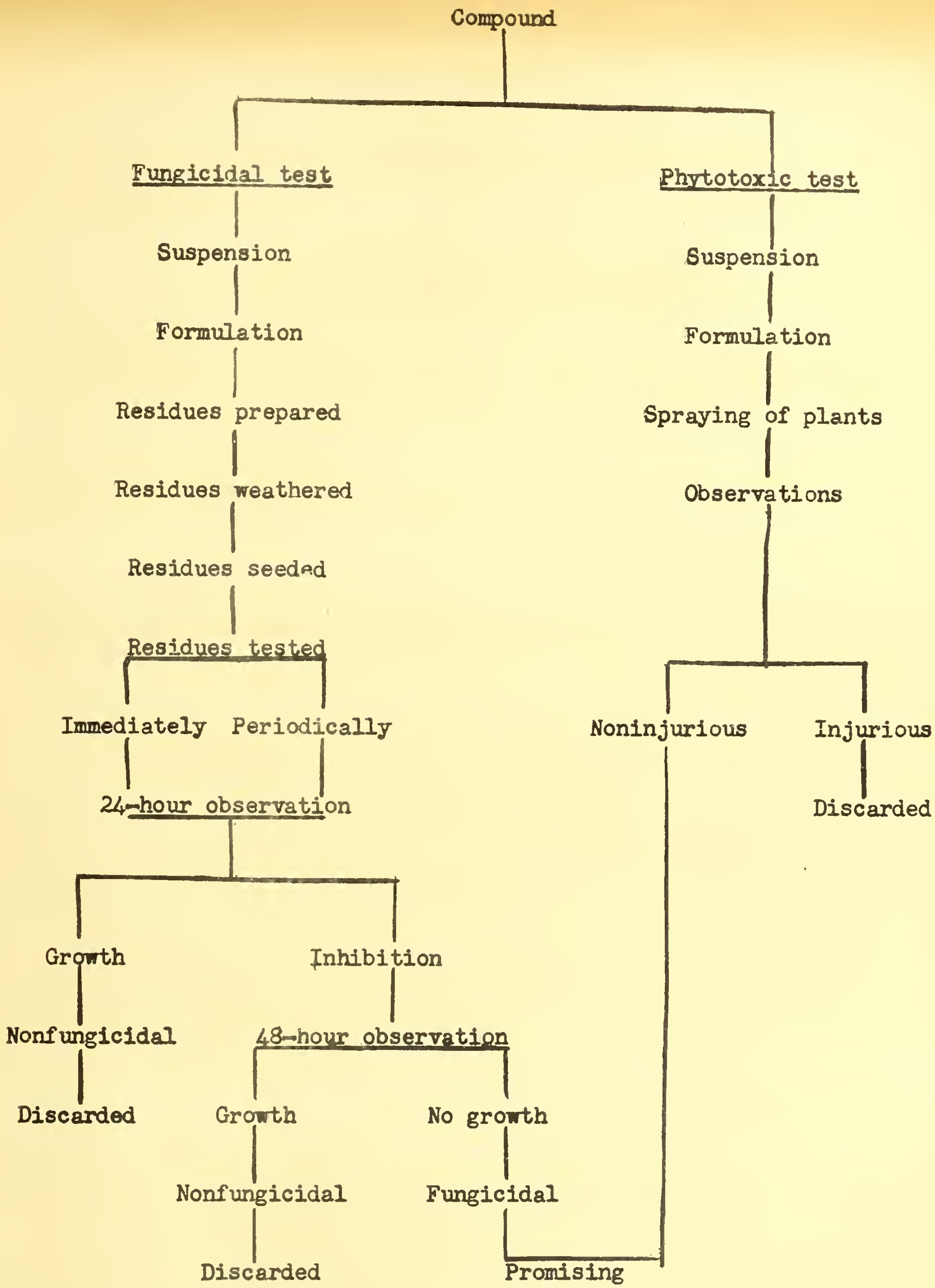

Figure 1. Diagram showing steps taken in the determination of fungicidal and phytotoxic properties of chemical compounds.

The deposits were prepared as follows: The suspension was transferred to clean glass cover slips, 25 by 50 mm., by means of a standard stirring rod, as described by Peterson.[3] The glass rod acted both as a stirrer and as a transfer agent. A small droplet of the suspension, not more than three-sixteenths of an inch in diameter, was centered on each half of the cover slip and allowed to dry out to form a residue. Eight such cover slips were made from each suspension. Each suspension had its own surface-tension effect upon the glass surface; therefore the droplets differed slightly. However, within the series of slides made up from any one suspension the areas covered were fairly uniform.

The next step was to test the residues for weathering properties. This was done by tying among the leaves of orchard trees special holders for the cover slips. Holders were made by fastening wooden pot labels to clip clothespins, the jaws of which were lined with cork. These clothespins held the glass cover slips in place, while the wooden pot labels protected them against breakage. Under these conditions the cover slips were subjected naturally to the varying environments of the tree. The residues were thus exposed usually for 14 days. After each 2-day period, or 3 days over week ends, 1 cover slip and its weathered residue was removed from the tree and taken to the laboratory. Each test consisted of samples of 25 different compounds hung among the leaves of a single large apple tree.

After the samples were brought into the laboratory, they were tested for their fungicidal effectiveness. The cover slips were cut into two parts, each of which then contained a single area of weathered residue. One half was seeded, by means of a uniform platinum loop, with a standardized suspension of the conidia of Monilinia fructicola and the other half with a standardized suspension of the conidia of Glomerella cingulata. The cover glasses with the seeded residues were then inverted over Van Tieghem cells (small glass humidity chambers) but were not sealed to them because the conidia needed oxygen for germination. Immediately the Van Tieghem cells with the cover slips were placed in large glass culture chambers, which were then sealed with water. The air trapped on the large culture chambers was thus available to the conidia.

To insure further that the supply of oxygen and nutrients was ample, the conidial suspensions were made up in distilled water, to which a synthetic nutrient solution (Czapek) was added at the rate of 1 ml. to each 10 ml. of distilled water. The suspension was diluted so that not more than 150,000 cells of the peach brown rot organism or more than 200,000 cells of the apple bitter rot organism occupied each milliliter of their respective medium.

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3 Peterson, P. D. The spore-germination method of evaluating fungicides. Phytopathology 31: 1108-1116. 1941.

The conidia seeded in the residues were incubated for 24 hours at 70° F. The reaction of the conidia to the chemicals was then observed under the microscope. If the conidia germinated, this was recorded and the conidia were discarded; otherwise they were recorded as being inhibited. Since the authors were not certain that the conidia had been injured, those inhibited were then transferred to the surface of nutrient agar to which no test chemical had been added. This was done by using a small piece of the agar surface as a sponge to soak up the conidia from the residue and place them in contact with the nutrient agar. The conidia were then incubated on the new surface for another 24-hour period at 70°. After a microscopic observation, a record was made as to whether they had been injured. Since the authors were concerned only with chemicals that kill and not with those that inhibit, a chemical was recorded as being a fungicide only when it killed all the conidia subjected to the test. Inhibition has been commonly encountered in these tests, and many of the chemicals examined appeared to cause a slight disturbance in the environment surrounding the conidia, which in no way was found to be deleterious.

With the methods and the intervals of time used, it was possible to obtain, at the most, six observations on the performance of any given chemical during a 14-day test period. Sometimes periods of excessive drought or rainfall were encountered. If a chemical showed a fungicidal property under these conditions, it was usually tested further. The fungicidal values shown in the tables were obtained from those tests that provided the most favorable response during one or more test periods.

Chemicals reacting favorably in both the fungicidal and the phytotoxic tests were selected as the most promising materials. To be of practical value the compound must be not only a good fungicide, but also stable, safe to handle, and noninjurious to the plants sprayed.

RESULTS

The compounds tested during the years 1938 to 1946 and their fungicidal effects on the conidia of *Monilinia fructicola* and *Glomerella cingulata* are given in tables 1 to 4. The phytotoxic effects of the materials on peach plants are shown in tables 2, 3, and 4.

The greatest number of chemicals (459) showed no fungicidal action (table 1). Most of these compounds also had no phytotoxic effect; and therefore results of these tests were omitted from the table.

The compounds found to show some fungicidal activity are listed in table 2. Phytotoxic effect and duration of the fungicidal action in the 14-day test period are also indicated. Of 47 compounds having fungicidal properties, 33 were found to cause some degree of plant injury and therefore were of no value for our specific purposes. Of these compounds, 11 were found to possess fungicidal action for only 1 or 2 days. It is thought that this rapid change in toxicity may be due to the loss of some volatile contaminating reaction product or to a rapid break-down of a rather unstable combination. Whatever the rason, such compounds are not useful as fungicides.

Only a few of the compounds appeared to show much promise, and these were tested further in mixtures with adjuvants and insecticides. The data for the tests are shown in table 3. Several of the promising organic acids - adipic, anisic, and p-chlorobenzoic - when mixed with lime lost their fungicidal properties. Adipic acid became extremely phytotoxic and lost its fungicidal property when mixed with nicotine-bentonite, but the fungicidal property of anisic acid was enhanced in this mixture. In general, the addition of lime to the organic acids caused them to lose their fungicidal properties and to become more injurious to the sprayed plants. Addition of lime appeared to lower the fungicidal value of benzamide, benzimidazole, and p,p'-thiodianiline. The chlorinated hydroxy aliphatic compounds appeared to be markedly affected physically by the addition of lime; yet their fungicidal properties were not changed. None of the compounds appeared to be changed in any of their characteristics by the addition of pyrophyllite.

Compounds possessing the least phytotoxic behavior and having the most promising fungicidal properties were p-chloro-alpha-isonitroso acetanilide, p-chlorobenzoic acid, 3,4-dichlorobenzoic acid, benzimidazole, benzamide, N-(o-methoxyphenyl) glycinonitrile, p,p-thiodianiline, 2,2'-methylenebis [4-chlorophenol], 2,2'-(2,2,2-trichloroethylidene)bis[4-chlorophenol], and 4,4'-isopropylidenediphenol. Of these 2,2'-methylene-bis[4-chlorophenol] and 3,4-dichlorobenzoic acid were used more extensively in further tests. Table 4 shows some of the mixtures used with those two compounds and the effect of these mixtures on their fungicidal and phytotoxic behavior.

SUMMARY

Data are presented on the effect of 506 synthetic organic compounds, when used as fungicides, on the conidia of Monilinia fructicola (Wint.) Honey, the pathogen that causes the well-known peach brown rot disease, and Glomerella cingulata (Ston.) Spauld. and Schrenk, the pathogen that causes the disease of apples known as bitter rot.

Of these compounds 456 failed to show any fungicidal effect on either organism, but 47 of them were found to be toxic to the conidia of the 2 fungi in some degree. The toxicity, however, of most of these compounds was so slight that they are of no real value as orchard or field fungicides. Many of these were also found to be toxic to peach foliage and were, therefore, useless as fungicides.

The 10 organic compounds which appeared to be the most promising as fungicides were the following:

1. Acetanilide, *p*-chloro-alpha-isonitroso-
2. Aniline, *p*,*p*'-thiodi-
3. Benzamide
4. Benzimidazole
5. Benzoic acid, *p*-chloro-
6. Benzoic acid, 3,4-dichloro-
7. Glycinonitrite, N-(*o*-methoxyphenyl)-
8. Phenol, 2,2'-methylenebis [4-chloro-
9. Phenol, 2,2'-(2,2,2-trichloroethylidene)bis[4-chloro-
10. Phenol, 4,4'-isopropylidenedi-

These organic compounds appear to possess satisfactory fungicidal properties, apparently are stable when mixed with insecticides, lime and adjuvants, and appear safe to use on tender peach foliage.

Table 1.--Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants

Compound[1/]	Pounds per 100 gallons	Adjuvant[2/]
Acetamide, N-anilino-alpha-phenyl-	1	B
Acetamide, 4-anilino-N,N'-phenylenebis-	2	0
Acetamide, alpha-ethyl-alpha-phenyl-	2	B
Acetanilide, m-chloro-alpha-(pentachlorophenoxy)-	1	B
Acetanilide, p-cyclohexylsulfamyl-	1	B
Acetanilide, p-(diethylsulfamyl)-	2	B
Acetanilide, m-hydroxy-	2	B
Acetanilide, o-hydroxy-	2	B
Acetanilide, p-hydroxy-	2	B
Acetanilide, alpha,alpha,alpha-2,5-pentachloro-	1	B
Acetanilide, p-(propylsulfamyl)-	2	B
Acetanilide, p,p'-sulfonylbis-	2	0
Acetic acid, 2,4-dinitrophenyl ester	2	C
Acetic acid, 2-phenylhydrazide	1	B
Acetic acid, alpha-(trichloromethyl) ester	1	B
Acetoacetanilide, o-chloro-	2	B
Acetoacetic acid, ethyl ester, semicarbazone	2	B
Acetonitrile, alpha-anilinophenyl-	1	B
Acetonitrile, alpha-(o-anisidino)phenyl-	1	B
Acetonitrile, alpha-(p-bromoanilino)phenyl-	1	B
Acetonitrile, alpha-(p-toluino)phenyl-	1	B
Acetophenone, semicarbazone	2	B
Acetophenone, p-chloro-, semicarbazone	2	B
Acetophenone, 3,4-dichloro-, semicarbazone	2	B
Acetophenone, p-hydroxy-	2	0
Acetophenone, p-methyl-, semicarbazone	2	B
Aniline, N-amyl-2,4-dinitro-	2	B
Aniline, N-butyl-2,4-dinitro-	2	B
Aniline, N,N-diethyl-2,4-dinitro-	2	B
Aniline, N,N-diisobutyl-2,4-dinitro-	2	B
Aniline, 2,4-dinitro-N-propyl-	2	B
Aniline, N-ethyl-2,4-dinitro-	2	B
Aniline, N-isobutyl-2,4-dinitro-	2	B
Aniline, N-isopropyl-2,4-dinitro-	1	B
Aniline, N-methyl-2,4-dinitro-	2	B
Aniline, p,p'-methylenedi-	1	B
Aniline, p,p'-oxydi-	2	0
Aniline, p,p'-sulfonyldi-	2	0
p-Anisidine	2	0
o-Anisidine, 5-chloro-	2	B
Anisole, 4-chloro-2-nitro-	2	B
Anisole, 2,4-dinitro-	2	C
9,10-Anthradiol, diacetate	2	0
Anthraquinone, 2-benzamido-	2	0

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Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1/]	Pounds per 100 gallons	Adjuvant[2/]
Anthraquinone, 2-bromo-	2	0
Anthranilic acid, N-ethoxyoxalyl-	2	0
Anthranilic acid, N,N'-oxalylbis-	2	0
2-Anthroic acid	1	B
Barbituric acid	2	0
Benzaldehyde, phenylhydrazone	2	B
Benzaldehyde, semicarbazone	2	B
Benzamide, N-amyl-m-nitro-	1	B
Benzamide, N-amyl-p-nitro-	1	B
Benzamide, N-sec-butyl-	2	0
Benzamide, N-butyl-m-nitro-	1	B
Benzamide, N-sec-butyl-m-nitro-	1	B
Benzamide, N-butyl-p-nitro-	1	B
Benzamide, N-sec-butyl-p-nitro-	1	B
Benzamide, N-cyclohexyl-m-nitro-	1	B
Benzamide, N,N-dibenzyl-	2	0
Benzamide, N-(2,5-dichlorophenyl)-N,N'-ethylenebis-	1	B
Benzamide, N,N-dicyclohexyl-	2	0
Benzamide, N,N-dicyclohexyl-m-nitro-	1	B
Benzamide, N,N-diethyl-p-nitro-	1	B
Benzamide, N,N-diisobutyl-	2	0
Benzamide, N,N-diisobutyl-p-nitro-	1	B
Benzamide, N,N-diisopropyl-	2	0
Benzamide, N,N-diisopropyl-p-nitro-	1	B
Benzamide, N,N-dimethyl-m-nitro-	1	B
Benzamide, N,N-dimethyl-p-nitro-	1	B
Benzamide, N,N-diphenyl-	2	0
Benzamide, N-hydroxymethyl-	1	B
Benzamide, N-isobutyl-m-nitro-	1	B
Benzamide, N-isobutyl-p-nitro-	1	B
Benzamide, N-isopropyl-	2	0
Benzamide, N-isopropyl-m-nitro-	1	B
Benzamide, N-isopropyl-p-nitro-	1	B
Benzamide, N-(1-methylamyl)-	2	0
Benzamide, N,N'-methylenebis-	1	B
Benzamide, N-methyl-m-nitro-	1	B
Benzamide, N-methyl-p-nitro-	1	B
Benzamide, p-nitro-N,N-dipropyl-	1	B
Benzamide, m-nitro-N-propyl-	1	B
Benzamide, p-nitro-N-propyl-	1	B
Benzamide, N,N'-m-phenylenebis-	2	0
Benzamide, N,N'-p-phenylenebis-	2	0
Benzamide, N-[2,2,2-trichloro-1-(hydroxyethyl)]-	1	B
Benzanilide, N-benzyl-	2	0
Benzanilide, 2'-bromo-	2	0
Benzanilide, 3'-bromo-	2	0

Footnotes on p. 105

Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1]	Pounds per 100 gallons	Adjuvant[2]
Benzanilide, 4'-bromo-	2	0
Benzanilide, 2'-chloro-	1	0
Benzanilide, 3'-chloro-	2	0
Benzanilide, 4'-chloro-	2	0
Benzanilide, 2'-chloro-3-nitro-	1	B
Benzanilide, 3'-chloro-3-nitro-	1	B
Benzanilide, 2',5'-dichloro-	2	0
Benzanilide, N-(1-naphthyl)-	2	0
Benzanilide, N-(2-naphthyl)-	2	0
Benzanilide, 2'-nitro-	2	0
Benzanilide, 3-nitro-	1	B
Benzanilide, 3'-nitro-	2	0
Benzanilide, 4'-nitro-	2	0
Benzanilide, o-phenyl-	2	0
o-Benzanisidide	2	0
p-Benzanisidide	2	0
Benzene, alpha,beta-dibromoethyl-	2	A
Benzene, 1,4-dichloro-2-nitro-	2	0
Benzene, 1-iodo-2-nitro-, dichloride	2	A
Benzene, 1-iodo-3-nitro-, dichloride	2	A
Benzene, 1-iodo-4-nitro-, dichloride	2	A
Benzene, 1-iodoso-2-nitro-	2	A
Benzene, 1-iodoso-4-nitro-	2	A
Benzenesulfonamide, N-(p-anisyl)-p-bromo-	2	0
Benzenesulfonamide, N-benzyl-	2	0
Benzenesulfonamide, p-bromo-N,N-dimethyl-	2	0
Benzenesulfonamide, p-bromo-N-ethyl-	2	0
Benzenesulfonamide, p-bromo-N-isobutyl	2	0
Benzenesulfonamide, p-bromo-N-propyl-	2	0
Benzenesulfonamide, p-bromo-N-(p-tolyl)-	2	0
Benzenesulfonamide, N-sec-butyl-	2	0
Benzenesulfonamide, N-butyl-p-chloro-	2	0
Benzenesulfonamide, p-chloro-N-propyl-	2	0
Benzenesulfonamide, N,N'-ethylenebis-	2	0
Benzenesulfonanilide, 4,4'-dibromo-	2	B
o-Benzenesulfonanisidide	2	B
Benzenesulfonic acid, p-bromophenyl ester	1	B
Benzenesulfonic acid, o-chlorophenyl ester	1	B
Benzenesulfonic acid, 2,4-dinitrophenyl ester	1	B
Benzenesulfonic acid, 1-naphthyl ester	1	B
Benzenesulfonic acid, 2-naphthyl ester	1	B
Benzenesulfonic acid, m-nitrophenyl ester	1	B
Benzenesulfonic acid, o-nitrophenyl ester	1	B
Benzenesulfonic acid, m-tolyl ester	1	B
Benzenesulfonic acid, p-tolyl ester	1	B
Benzenesulfonic acid, 4-tert-butyl-2-chlorophenyl ester	1	B

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Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1/]	Pounds per 100 gallons	Adjuvant[2/]
Benzenesulfonic acid, p-tert-butylphenyl ester	1	B
Benzenesulfonic acid, 2,4,6-trichlorophenyl ester	1	B
Benzenesulfonic acid, xenyl ester	1	B
o-Benzenesulfonophenetidide	2	B
m-Benzenesulfonotoluidide	2	O
o-Benzenesulfonotoluidide	2	O
Benzil, semicarbazone	2	B
1,3-Benzisoxazine, 4-cyano-2,4-dihydro-2-(o-hydroxyphenyl)-3-phenyl-	1	B
1,3-Benzodioxan, 2,4-bis(trichloromethyl)-6-nitro-	1	B
Benzofuro[3,2-b]benzofuran, 2,7-diol,4b,9b-diphenyl-	2	O
Benzofuro[3,2-b]benzofuran, 2,7-diol,4b,9b-diphenyl, diacetate	2	O
Benzofuro[3,2-b]benzofuran, 2,7-diol,4b,9b-diphenyl, dipropionate	2	O
Benzoic acid	2	O
Benzoic acid, p-benzamido-, ethyl ester	2	O
Benzoic acid, o-bromo-	2	O
Benzoic acid, 4-tert-butylphenyl ester	1	B
Benzoic acid, 4-chlorophenyl ester	1	B
Benzoic acid, p-nitro-, benzyl ester	1	B
Benzoic acid, p-nitro-, p-bromophenyl ester	1	B
Benzoic acid, p-nitro-, 2-chloroethyl ester	1	B
Benzoic acid, p-nitro-, o-chlorophenyl ester	1	B
Benzoic acid, p-nitro-, p-chlorophenyl ester	1	B
Benzoic acid, p-nitro-, cyclohexyl ester	1	B
Benzoic acid, p-nitro-, 2,4-dinitrophenyl ester	1	B
Benzoic acid, p-nitro-, ethyl ester	1	B
Benzoic acid, p-nitro-, hydrazide	2	O
Benzoic acid, p-nitro-, isobutyl ester	1	B
Benzoic acid, p-nitro-, isopropyl ester	1	B
Benzoic acid, p-nitro-, methyl ester	1	B
Benzoic acid, p-nitro-, 2-naphthyl ester	1	B
Benzoic acid, p-nitro-, o-nitrophenyl ester	1	B
Benzoic acid, p-nitro-, phenyl ester	1	B
Benzoic acid, m-nitro-, 2-phenylhydrazide	1	B
Benzoic acid, p-nitro-, 2-phenylhydrazide	1	B
Benzoic acid, p-nitro-, propyl ester	1	B
Benzoic anhydride	2	O
o-Benzophenetidide	2	O
p-Benzophenetidide	2	O
Benzophenone, phenylhydrazone	2	B
Benzophenone, semicarbazone	2	B
Benzophenone, 4-amino-, semicarbazone	2	B
Benzophenone, 4,4'-diamino-	2	O
Benzothiazole, 2,2'-dithiobis-	1	B

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Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1]	Pounds per 100 gallons	Adjuvant[2]
Benzyl alcohol, alpha-(trichloromethyl)-	1	B
Benzylamine, N-nitroso-N-phenyl-	2	O
Bibenzyl, alpha,alpha'-dibromo-	2	O
p-Bromobenzenesulfonic acid, p-nitrophenyl ester	2	O
Butyraldehyde, semicarbazone	2	B
Butyraldehyde, alpha-ethyl-, semicarbazone	2	B
Butyramide, alpha,alpha,beta-,trichloro-	1	B
Butyranilide	2	B
Butyric acid, phenylhydrazide	1	B
Carbamic acid, (2,2,2-trichloro-1-hydroxyethyl)-	1	B
Carbazole, 9-benzoyl-	2	O
Carbonic acid, diphenyl ester	2	A
Catechol	2	A
Centralite	2	O
Chalcone, 4'-methyl-3,4-methylenedioxy-	2	O
Cinnamaldehyde, semicarbazone	2	B
Cinnamamide, N-amyl-	1	B
Cinnamamide, N-anilino-	1	B
Cinnamamide, N-butyl-	1	B
Cinnamamide, N-sec-butyl-	1	B
Cinnamamide, N-isopropyl-	1	B
Cinnamamide, N-propyl-	1	B
o-Cresol, 4,6-dibromo-	2	A
o-Cresol, 3,4,6-trichloro-alpha-(2,3,5-trichloro-6-methoxyphenyl)-	1	B
Crotonaldehyde, semicarbazone	2	B
1,4-Cyclohexanedione, 2,5-bis(p-methylphenoxy)-	2	O
Cyclopentanone, semicarbazone	2	B
1,3-Diazaspiro[4,4]nonane-2,4-dione	2	O
Dibenzothiophene, 5-dioxide	2	O
Dibenzothiophene, 3-nitro-, 5-dioxide	2	O
Dibenzylamine, N-[2-(2,4-dinitrophenoxy)ethyl]-	1	B
Dibenzylamine, N-[2-(pentachlorophenoxy)ethyl]-	1	B
Diphenylamine, 3-chloro-2,4-dinitro-	2	B
Diphenylamine, 4-chloro-2,4-dinitro-	2	B
Diphenylamine, N-ethyl-2,4-dinitro-	2	B
Diphenylamine, 2'-methoxy-2,4-dinitro-	2	B
Diphenylamine, 2'-methyl-2,4-dinitro-	2	B
Diphenylamine, 3'-methyl-2,4-dinitro-	2	B
Diphenylamine, 4'-methyl-2,4-dinitro-	2	B
Diphenylamine, N-methyl-2,4-dinitro-	2	B
Disulfide, bis(o-nitrophenyl)-	2	A
Ethane, 1-(4-biphenylyl)-2,2,2-trichloro-1-phenyl-	1	B
Ethane, 2,2-bis(p-acetoxyphenyl)-1,1,1-trichloro-	1	B
Ethane, 2,2-bis(p-bromophenyl)-1,1,1-trichloro-	2	B
Ethane, 1,1-dibromo-2,2-bis(p-bromophenyl)-	1	B

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Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1/]	Pounds per 100 gallons	Adjuvant[2/]
Ethane, 1,1-dibromo-2,2-bis(p-chlorophenyl)-	1	B
Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-	1	B
Ethane, 1,1,1-tribromo-2,2-bis(p-bromophenyl)-	1	B
Ethane, 1,1,1-tribromo-2,2-bis(p-chlorophenyl)-	1	B
Ethane, 1,1,1-trichloro-2,2-bis(5-chloro-2-methoxyphenyl)-	1	B
Ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-	2	B
Ethane, 1,1,1-trichloro-2,2-bis(3,5-dichloro-2-methoxyphenyl)-	1	B
Ethane, 1,1,1-trichloro-2,2-bis(3,5-dichloro-4-methoxyphenyl)-	1	B
Ethane, 1,1,1-trichloro-2,2-bis(3,4-dimethoxyphenyl)-	1	B
Ethane, 1,1,1-trichloro-2,2-bis(p-methoxyphenyl)-	2	B
Ethane, 1,1,1-trichloro-2,2-diphenyl-	2	B
Ethane, 1,1,1-trichloro-2,2-di-p-tolyl-	2	B
Ethanol, 2,2,2-trichloro-1-(2,4-dihydroxyphenyl)-	1	B
Ether, 4,6-dinitro-o-tolyl ethyl	2	B
Ether, 4,6-dinitro-m-tolyl methyl	2	0
Ethylene, 2,2-bis(p-bromophenyl)-1,1-dichloro-	2	B
Ethylene, 1,1-dichloro-2,2-bis(p-chlorophenyl)-	2	B
Ethylene, 1,1-dichloro-2,2-diphenyl-	2	B
Ethylenediamine, N,N'-bis(2,4-dinitrophenyl)-	2	B
2-Furaldehyde, semicarbazone	2	B
9,10[3',4']-Furanoanthracene-12,14-dione, 9,10,11,15-tetrahydro-	1	B
Glycinonitrile, N-o-anisyl-	1	B
Glycinonitrile, N-1-naphthyl-alpha-phenyl-	1	B
Glycinonitrile, N-phenyl-	1	B
Glycinonitrile, N-p-tolyl-	1	B
2-Heptanone, semicarbazone	2	B
4-Heptanone, 2,3,5,6-tetrabromo-2,6-dimethyl-	2	0
2,5-Hexanedione, disemicarbazone	2	B
Hydantoin, 5-(p-chlorophenyl)-5-methyl-	2	0
Hydantoin, 5-methyl-5-phenyl-	2	0
Hydrazine, 1,2-dibenzoyl-1-phenyl-	2	0
Hydrazine, 1-ethoxalyl-2-phenyl-	1	B
Hydrazine, 1-phenyl-2-sulfonyl-	1	B
Hydrazine, 1-phenyl-2-(p-tolylsulfonyl)-	1	0
Hydrocinnamic acid, alpha,beta-dibromo-, ethyl ester	2	A
Hydroquinone, diamyl-	2	A
Hydroquinone, dibenzenesulfonic acid ester	2	0
Isobutyric acid, 2-phenylhydrazide	1	B
Isocaproic acid, 2-phenylhydrazide	1	B
Isovalerone, semicarbazone	2	B

Footnotes on p. 105

Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1/]	Pounds per 100 gallons	Adjuvant[2/]
Ketone, ethyl methyl, semicarbazone	2	B
Ketone, 4-hydroxy-3-methoxystyryl methyl	2	B
Ketone, methyl propyl, semicarbazone	2	B
Ketone, 1-naphthyl phenyl	2	B
Lauric acid, 4,6-dinitro-o-tolyl-	2	O
Levulinic acid, semicarbazone	2	B
Maleimide, N-anilino-	1	B
Morpholine, 4-(3-chloro-2-hydroxybenzyl)-	1	B
Morpholine, 4-(5-chloro-2-hydroxybenzyl)-	1	B
Morpholine, 4-(o-hydroxybenzyl)-	1	B
Morpholine, 4-(p-methoxy-alpha-thiotoluyl)-	2	B
Morpholine, 4-(p-methyl-alpha-thiotoluyl)-	2	B
Morpholine, 4-(m-nitrobenzoyl)-	1	B
Morpholine, 4-phenyl-	2	O
Morpholine, 4-(phenylsulfonyl)-	2	O
Morpholine, 4-(alpha-thiotoluyl)-	2	B
Morpholine, 4-(p-tolylsulfonyl)-	2	O
2-Naphthalenesulfonamide, N,N-diethyl-	2	B
2-Naphthalenesulfonamide, N,N-dimethyl-	2	B
2-Naphthalenesulfonamide, N-ethyl-	2	B
2-Naphthalenesulfonamide, N-methyl-	2	B
2-Naphthalenesulfonamide, N-propyl-	2	B
2-Naphthoic acid, 3-hydroxy-	2	A
1-Naphthol	2	A
2-Naphthol, 1,1'-methylene-di-	1	B
1-Naphthol, 2-(p-nitrophenylazo)-	2	B
2-Naphthol, 1-(o-nitrophenylmercapto)-	2	C
2-Naphthol, 1-(p-phenylazophenylazo)-	2	A
2-Naphthylamine, N-(2,4-dinitrophenyl)-	2	B
2-Octanone, semicarbazone	2	O
Oleic acid, chlorinated, sulfonated	2	A
Oleic acid, chlorinated, sulfonated, calcium salt	2	A
Oleic acid, sulfonated, barium salt	2	A
Oleic acid, sulfonated, calcium salt	2	A
Oxalic acid, dimethyl ester	2	O
Oxamide	1	O
Oxamide, N,N'-bis(p-chlorophenyl)-	2	B
Oxamide, N,N'-dianilino-	1	B
Oxanilic acid, p-chloro-, ethyl ester	2	B
Oxanilic acid, 2,4-dichloro-, ethyl ester	2	B
Palmitic acid, 4,6-dinitro-o-tolyl-	2	O
2,4-Pentadien-1-one, 1,5-diphenyl-	2	O
2-Pentanone, 4-methyl-, semicarbazone	2	B
Phenol, m-amino-	2	A
Phenol, p-amino-	2	A
Phenol, p-bromo-	2	A

Footnotes on p. 105

Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1]	Pounds per 100 gallons	Adjuvant[2]
Phenol, p-tert-butyl-	2	B
Phenol, 4-chloro-2-phenyl-	2	A
Phenol, o-cyclohexyl-	2	A
Phenol, 2-cyclohexyl-4,6-dinitro-, methyl ester	2	B
Phenol, 2,4-dinitro-	2	A
Phenol, p-(2,4-dinitroanilino)-	2	A
Phenol, 2-methoxy-(2,4-dinitrostyryl)-	2	B
Phenol, 2,2'-methylenebis[4-chloro-, diacetic acid ester	1	B
Phenol, 2,2'-methylenebis[4,6-dichloro-	1	B
Phenol, 3,3'-methylenebis[2,4,6-trichloro-	1	B
Phenol, pentachloro-	2	A
Phenol, o-phenyl-	2	A
Phenol, 2,4'-sulfonyldi-	1	B
Phenol, 4,4'-sulfonyldi-	1	B
Phenol, 2,2'-(2,2,2-trichloroethylidene)bis[6-bromo-4-chloro-	1	B
Phenol, 2,2'-(2,2,2-trichloroethylidene)bis[4-chloro-6-nitro-	1	B
Phenol, 2,2'-(2,2,2-trichloroethylidene)bis[4,6-dichloro-	1	B
Phenol, 4,4'-(2,2,2-trichloroethylidene)di-	1	B
Phenoquinone	2	O
Phenothiazine + 100% sulfur	2	C
Phenylacetic acid, 2-phenylhydrazide	1	B
p-Phenylenediamine, N'-(alpha-benzoyl)benzylidene-N,N-dimethyl-	2	O
p-Phenylenediamine, N'-benzylidene-N,N-dimethyl-	2	O
p-Phenylenediamine, N,N-dimethyl-N'-piperonylidene-	2	O
Phenylsulfuramine, S-o-nitro-	2	C
Phthalanilic acid, m-chloro-	2	O
Phthalonitrile	2	C
Phthalamic acid, N-thiocarbamyl-	2	O
Phthalamide	2	O
1,4-Phthalazinedione, 2,3-dihydro-3-phenyl-	1	B
Phthalide	2	O
Phthalimide, N-anilino-	1	B
Phthalimide, N-benzyl-	1	B
Phthalimide, N-(p-bromophenyl)-	2	O
Phthalimide, N-(m-chlorophenyl)-	1	B
Phthalimide, N-(o-chlorophenyl)-	1	B
Phthalimide, N-(p-chlorophenyl)-	2	B
Phthalimide, N-cyclohexyl-	1	B
Phthalimide, N-(2,5-dichlorophenyl)-	1	B
Phthalimide, N-ethyl-	2	O
Phthalimide, N-hydroxyethyl-	1	B

Footnotes on p. 105

Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1/]	Pounds per 100 gallons	Adjuvant[2/]
Phthalimide, N-isobutyl-	2	O
Phthalimide, N-isopropyl-	2	B
Phthalimide, N-methyl-	2	O
Phthalimide, N-1-naphthyl-	1	B
Phthalimide, N-2-naphthyl-	1	B
Phthalimide, N-(m-nitrophenyl)-	1	B
Phthalimide, N-(o-nitrophenyl)-	1	B
Phthalimide, N-(p-nitrophenyl)-	1	B
Phthalimide, N-(5-nitro-o-tolyl)-	1	B
Phthalimide, N-octyl-	1	B
Phthalimide, N-phenyl-	2	O
Phthalimide, N-propyl-	2	O
Phthalimide, N-m-tolyl-	1	B
Phthalimide, N-o-tolyl-	2	O
Phthalimide, N-p-tolyl-	1	B
Piperazine, 1,4-dibenzoyl-	2	O
1-Piperidineacetonitrile, alpha-(o-hydroxyphenyl)-	1	B
1-Piperidineacetonitrile, alpha-(p-methoxyphenyl)-	1	B
1-Piperidineacetonitrile, alpha-phenyl-	1	B
Piperidine, 1-(p-bromophenylsulfonyl)-	2	O
Piperidine, 1-(2,4-dinitrophenyl)-	2	B
Piperidine, 1-(m-nitrobenzoyl)-	1	B
Piperidine, 1-(o-nitrophenyl)-	1	B
Piperidine, 1-(p-nitrophenyl)-	1	B
Piperidine, 1-(phenylsulfonyl)-	2	O
Piperidine, 1-(p-tolylsulfonyl)-	2	B
Piperonal, phenylhydrazone	2	B
Piperonal, semicarbazone	2	B
Piperonyloin	2	O
Prontosil (soluble)	2	A
Propionamide, alpha,alpha-dichloro-	1	B
Propionic acid, 4,6-dinitro-o-tolyl-	1	O
Pseudourea, 3-(p-acetaminophenylsulfonyl)-2-thio-	2	O
Pseudourea, 3-(p-aminophenylsulfonyl)-2-methylthio-	2	B
Pseudourea, 3-(phenylsulfonyl)-2-methylthio-	2	O
Pseudourea, 3-(p-bromophenylsulfonyl)-2-naphthylthio-	2	B
Pseudourea, 3-(m-nitrophenylsulfonyl)-2-methylthio-	2	B
Pseudourea, 3-(p-tolylsulfonyl)-2-methylthio-	2	B
Pseudourea, 3-(p-xylylsulfonyl)-2-methylthio-	2	B
Pyridine, 4-nitrophenyl-	2	O
Pyrocatechol, diacetate	1	B
p-Quinone, 2,5-bis(phenylmercapto)-	2	O
p-Quinone, 2,6-bis(phenylmercapto)-	2	O
Quinoxaline, 2,3-dihydroxy-	2	O

Footnotes on p. 105

Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1]	Pounds per 100 gallons	Adjuvant[2]
Resorcinol	2	A
Rhodanine, 5-(2-furfurylidene)-	2	B
Rhodanine, 5-(3-hydroxy-2-methoxybenzylidene)-	2	B
Rhodanine, 5-(4-hydroxy-3-methoxybenzylidene)-	2	B
Rhodanine, 5-(p-methoxybenzylidene)-	2	B
Rhodanine, 5-(3,4-methylenedioxybenzylidene)-	2	B
Salicylaldehyde, semicarbazone	2	O
Salicylic acid, 5-amino-, hydrochloride	2	O
Salicylic acid, sulfo-	2	A
Salol	2	A
Semioxamazide, 5-butyl-1-phenyl-	1	B
Semioxamazide, 5-ethyl-1-phenyl-	1	B
Semioxamazide, 5-isobutyl-1-phenyl-	1	B
Semioxamazide, 5-methyl-1-phenyl-	1	B
Semioxamazide, 1-phenyl-	1	B
Semioxamazide, 1-phenyl-5-propyl-	1	B
Stearic acid, 2-phenylhydrazide	1	B
Stilbene, 2,4-dinitro-	2	B
2,2'-Stilbenediol, 3,3',5,5'-tetrachloro-	1	B
Stilbene, 4'-methoxy-2,4-dinitro-	2	B
Succinic acid, alpha, beta-dibromo-	1	B
Sulfide, acetonyl o-nitrophenyl-	2	C
Sulfone, bis(p-bromophenyl)-	2	O
Sulfone, bis(4-chloro-3-nitrophenyl)	1	B
Sulfone, phenyl	2	O
Sulfone, p-tolyl-	2	O
Sulfur thiocyanate	2	O
m-Terphenyl	2	O
o-Terphenyl	2	O
Terphenyls (mixed)	2	O
1,3,5,7-Tetroxacyclooctane, 2,6-bis(trichloromethyl)-	1	B
Thianthrene	2	C
Thianthrene, 3,7-dimethyl-	2	C
4-Thiazolidone, 5-(2,3-dimethoxybenzylidene)-2-thio-	2	B
Thymol, 6-chloro-	2	A
Toluene-2,4-diamine	2	O
p-Toluenesulfonamide, N-benzyl-	2	B
p-Toluenesulfonamide, N-sec-butyl-	2	B
p-Toluenesulfonamide, N-cyclohexyl-	2	B
p-Toluenesulfonamide, N,N-diethyl-	2	B
p-Toluenesulfonamide, N,N-diisobutyl-	2	B
p-Toluenesulfonamide, N-ethyl-	2	B
p-Toluenesulfonamide, N,N'-ethylenebis-	1	B
p-Toluenesulfonic acid, 2-naphthyl ester	1	B

Footnotes on p. 105

Table 1.—Organic compounds showing no fungicidal action when applied as sprays formulated with and without adjuvants - Continued

Compound[1]	Pounds per 100 gallons	Adjuvant[2]
p-Toluenesulfonic acid, o-nitrophenyl ester	1	B
p-Toluenesulfonic acid, p-nitrophenyl ester	1	B
p-Toluenesulfonic acid, m-tolyl ester	1	B
p-Toluenesulfonic acid, p-tolyl ester	1	B
p-Toluenesulfon-o-anisidide	2	B
p-Toluenesulfono-o-penetidide	2	B
p-Toluenesulfono-m-toluidide	2	B
p-Toluenesulfono-o-toluidide	2	B
alpha-Toluenethiol, p-nitro-	2	A
o-Toluidine, 4-bromo-	2	A
o-Toluidine, 5-nitro-	2	C
Triazene, 1,3-ditolyl-	2	A
s-Trioxane, 2,4-bis(trichloromethyl)-	1	B
s-Trithiane	2	A
Urea, 1,3-bis(1-hydroxy-2,2,2-trichloroethyl)-	1	B
Urea, 1-(2,5-dichlorophenyl)-	1	B
Urea, 1-(2,2,2-trichloroethylidene)-3-(2,2,2-trichloro-1-hydroxyethyl)-2-thio-	1	B
Vanillin, semicarbazone	2	B
o-Veratraldehyde, phenylhydrazone	2	B
o-Veratraldehyde, semicarbazone	2	O

1/ The compounds in all tables are named in the inverted form as used in Chemical Abstracts index in order to group together chemically related compounds as far as possible.

2/ O, No adjuvant; A, 2 lb. Wyoming bentonite + 4 lb. hydrated lime; B, 1 or 2 lb. pyrophyllite; C, 4 lb. hydrated lime.

Table 2.—Results of fungicidal and phytotoxic tests with organic chemicals that alone or with adjuvants showed fungicidal activity

Compound	Pounds per 100 gallons	Adjuvant[1]	Days effective during 14-day test period against conidia of – Monilinia fructicola	Glomerella cingulata	Injury to Peach
Acetanilide, p-chloro-alpha-isonitroso-	2	0	11	11	None
Acetic acid, o-chlorophenoxy-	2	0	12	12	Severe
Acetic acid, p-chlorophenoxy-	2	0	12	12	Severe
Adipic acid	2	0	6	6	Moderate
Aniline, p,p'-thiodi-	2	0	14	14	None
Anisic acid	2	0	11	11	None
Benzamide	2	0	14	14	Mild
Benzamide, N-isobutyl-	2	0	12	4	Moderate
Benzene, iodo-	2	A	2	0	Slight
Benzenesulfonamide, N-amyl-p-bromo-	2	0	1	1	None
Benzenesulfonamide, N-benzyl-p-bromo-	2	0	1	1	Mild
Benzenesulfonamide, p-bromo-N-(m-chlorophenyl)-	2	0	1	1	Mild
Benzenesulfonamide. p-bromo-N-(o-chlorophenyl)-	2	0	1	1	Severe
Benzenesulfonamide, p-bromo-N-(p-chlorophenyl)-	2	0	1	1	Moderate
Benzenesulfonamide, p-bromo-N-(o-tolyl)-	2	0	1	0	None
Benzenesulfonamide, N-ethyl-	2	0	9	5	Moderate
Benzimidazole	2	0	11	11	None
2-Benzofurancarboxylic acid	2	B	11	11	Moderate
Benzoic acid, 2-bromo-3-nitro-	1	0	11	11	Severe
Benzoic acid, o-chloro-	1	0	9	11	Slight
Benzoic acid, p-chloro-	1	0	11	11	None
Benzoic acid, 3,4-dichloro-	1	B	14	14	None
Benzoic acid, 2-phenylhydrazide	2	B	2	2	Severe
2-Biphenylamine	2	0	2	2	None
Cinnamic acid	2	0	11	11	Moderate
Cinnamic acid, 3,4-methylenedioxy-	2	0	2	0	Slight

Table 2.--Results of fungicidal and phytotoxic tests with organic chemicals that alone or with adjuvants showed fungicidal activity - Continued

Compound	Pounds per 100 gallons	Adjuvant[1]	Days effective during 14-day test period against conidia of - Monilinia fructicola	Glomerella cingulata	Injury to Peach
p-Cresol, alpha-phenyl-	2	B	14	14	Moderate
Diphenylamine, 2,4,4'-trinitro-	2	B	14	11	Severe
Glycinonitrile, N-(o-methoxyphenyl)-	1	B	14	14	None
Hydrazine, 1-phenyl-2-phenylsulfonyl-	2	B	8	8	Slight
Hydrocinnamic acid, alpha,beta-dibromo-	2	0	9	11	Mild
Lauramide, N-butyl-	2	0	9	4	None
Myristic acid, 4,6-dinitro-o-cresyl ester	2	0	1	4	Slight
Nicotinonitrile, 6-chloro-2,4-dihydroxy-	1	0	5	5	None
Phenol, o-amino-	2	A	6	6	Moderate
Phenol, p-benzylamino-	2	B	14	7	Moderate
Phenol, 1,1-cyclohexane-4,4'-bis[2,6-dichloro-	1	B	1	1	None
Phenol, 4,4'-isopropylidenedi-	1	B	11	11	None
Phenol, 2,2'-methylenebis[4-chloro-	1	B	14	14	Slight
Phenol, 2,2'-methylenebis[3,4,6-trichloro-	1	B	8	0	None
Phenol, 2,2'-(2,2,2-trichloroethylidene)bis-[4-chloro-	1	B	14	14	None
Phthalic anhydride, 3-nitro-	2	0	0	6	Severe
Propionic acid, 2,4-dinitrophenyl ester	1	0	14	14	None
Propiophenone, p-hydroxy-	2	0	6	0	Mild
Stilbene, 2,4-dinitro-3',4'-methylenedioxy-	2	B	14	7	Mild
Triethylamine, 2-pentachlorophenoxy-	1	B	8	8	Severe
o-Veratramide	2	B	7	0	Severe

1/ 0, No adjuvant; A, 2 lb. Wyoming bentonite + 4 lb. hydrated lime; B, 1 or 2 lb. pyrophyllite.

Table 3.—Results of fungicidal and phytotoxic tests with organic chemicals that had previously shown activity, when used alone or with adjuvants, with insecticides or with mixtures of adjuvants and insecticides

Compound	Pounds per 100 gallons	Adjuvant	Days effective during 14-day test period against conidia of –		Injury to peach
			Monilinia fructicola	*Glomerella cingulata*	
Acetic acid, o-chlorophenoxy-	2	Lime	0	0	Moderate
Acetic acid, p-chlorophenoxy-	2	Lime	0	0	Moderate
Adipic acid	2	Lime	0	0	None
	2	Nicotine-bentonite	0	0	Severe
Aniline, p,p'-thiodi-	2	Lime	9	7	None
Anisic acid	2	Lime	0	0	Slight
	2	Nicotine-bentonite	14	14	Very slight
Benzamide	2	Lime	10	6	Moderate
Benzimidazole	2	Lime	9	7	None
2-Benzofurancarboxylic acid	2	Lime	0	0	Severe
Benzoic acid, 2-bromo-3-nitro-	1	Lime	0	0	Severe
	1	Nicotine-bentonite	14	14	Severe
Benzoic acid, o-chloro-	1	Lime	0	0	Mild
Benzoic acid, p-chloro-	1	Lime	0	0	Moderate
Benzoic acid, 3,4-dichloro-	1	DDT-pyrophyllite	14	14	None
Cinnamic acid	2	None	11	11	Moderate
	2	Lime	0	0	Mild
Phenol, 4,4'-isopropylidenedi-	2	None	11	11	None
Phenol, 2,2'-methylenebis-/4-chloro-	1	Lime	14	14	None
	1	Lead arsenate	14	14	Lead arsenate
	1	Lime-bentonite	14	14	None
Phenol, 2,2'-(2,2,2-trichloroethylidene) bis/4-chloro-	1	None	14	14	None
Propionic acid, 2,4-dinitrophenyl ester	1	Lime	0	0	Severe

Table 4.--Results of fungicidal and phytotoxic tests with 3,4-dichlorobenzoic acid and 2,2'-methylenebis[4-chlorophenol] when used alone or mixed with adjuvants and insecticides

Formulation[1]	Days effective during 14-day test period against conidia of – Monilinia fructicola	Glomerella cingulata	Injury to peach
3,4-Dichlorobenzoic acid plus–			
Pyrophyllite 2 + lead arsenate 2	14	14	Typical of lead arsenate
Pyrophyllite 2 + benzene hexachloride 2	14	14	None
Pyrophyllite 2 + hexaethyl tetraphosphate (1-16000)	14		Severe
Pyrophyllite 1	14	14	None
Polyethylene polysulfide 2 qt.	3	3	None
Polyethylene polysulfide 2 qt. + DDT	6	6	None
Polyethylene polysulfide 2 qt. + benzene hexachloride 2 + phenothiazine 2	9	6	None
Polyethylene polysulfide 2 qt. + DDT 1 + phenothiazine 2	9	6	None
Polyethylene polysulfide 2 qt. + lead arsenate 2	9	6	Typical of lead arsenate
Polyethylene polysulfide 2 qt. + phenothiazine 2 + lead arsenate 2	9	6	Typical of lead arsenate
Polyethylene polysulfide 2 qt. + phenothiazine 2	9	9	None
2,2'-Methylenebis[4-chlorophenol] plus–			
None	14	14	None
Pyrophyllite 1	14	14	None
Lead arsenate 1	14	14	Severe (lead arsenate)
Hydrated lime 2	14	14	None
Lead arsenate 1 + hydrated lime 2	14	14	Mild (lead arsenate)
Hydrated lime 2 + bentonite 1	14	14	None
DDT 1	14	14	None
Starch acetate 1/10	14	14	None
DDT 1 + starch acetate 1/10	14	14	None

1/ Figures indicate pounds per 100 gal. unless otherwise designated.

THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

AGRICULTURAL RESEARCH ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE

SECOND ANNUAL REPORT OF THE SPECIAL COMMITTEE ON THE COORDINATION OF FIELD TESTS WITH NEW FUNGICIDAL SPRAYS AND DUSTS, WITH REFERENCE TO THE RESULTS OBTAINED IN 1948

Supplement 183 April 15, 1949

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station — Beltsville, Maryland

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FOREWORD

Most of the committee personnel was continued as in 1947. No work was arranged by the sub-committee on carrots, celery, and onions due to absence from the country of the chairman, Dr. A. G. Newhall. The sub-committee on stone and small fruits did not come to a definite agreement on cooperative plans in time to start the 1948 season and thus have no report for this year. The work on ornamentals was limited to a series of tests on the treatment of gladiolus corms for the control of some of the diseases to which they are subject, and was under the direction of J. L. Forsberg as sub-chairman. The individual members that cooperated in the various sub-committees are listed by the sub-chairmen, whose names are listed below.

Sub-chairmen in charge of crop divisions,--

Apples	J. M. Hamilton	Geneva, New York
Carrots, onions, and celery	A. G. Newhall	Ithaca, New York
Cucurbits	J. W. Heuberger	Newark, Delaware
Ornamentals	A. W. Dimock	Ithaca, New York
Potatoes	W. F. Buchholtz	Ames, Iowa
Stone and small fruits	H. F. Winter	Wooster, Ohio
Tomatoes	M. B. Linn	Urbana, Illinois

Advisory members,--

Agricultural Engineering	Frank Irons	USDA Eng. Lab., Toledo, Ohio
Chemistry	E. G. Witman	Sherwin-Williams Co. Cleveland, Ohio
Experiment Stations, USDA	H. P. Barss	Office of Exp. Statio[ns] Washington, D. C.
Entomology	H. F. Dietz	DuPont Company Wilmington, Delawar[e]
Extension	O. C. Boyd	Agric. Exp. Station Amherst, Massachuse[tts]
Industry	L. G. Utter	Phelps Dodge Corp. New York, New York

Plot Design and data analysis	F. M. Wadley	Bureau of Entomology & Plant Quarantine Washington, D. C.
General Chairman	J. D. Wilson	Wooster, Ohio

The Committee wishes to express its gratitude to the following individuals and / or manufacturers who cooperated through the shipment of fungicidal materials to the various cooperators, --

Carbide and Carbon Chemicals Corporation	R. H. Wellman
Dow Chemical Company	W. W. Allen
DuPont de Nemours Company	B. L. Richards
Gallowhur Chemical Corporation	Morton Sorrell
General Chemical Company	J. F. Adams
Goodrich Chemical Company	S. L. Hopperstead
Harshaw Chemical Company	G. M. Juredine
Monsanto Chemical Company	H. E. Bruner
Naugatuck Chemical Company	H. D. Tate
Rohm and Haas Chemical Company	F. B. Maughan
Sherwin-Williams Company	E. D. Witman
Tennessee Copper Company	A. A. Nikitin

J. D. Wilson, General Chairman.

INDEX OF FUNGICIDES AND CROPS ON WHICH THEY WERE USED IN THE VARIOUS TRIALS

Fungicides	Crops
Arasan	Gladiolus
Bioquin	Apples, tomatoes
Bordeaux mixture	Cucumbers, potatoes, tomatoes
341 B	Apples
341 C	Apples
Ceresan N. I. and M	Gladiolus
COC-S	Potatoes, tomatoes
Copper A	Cucumbers, tomatoes
Copper zinc chromate	Cucumbers, potatoes, tomatoes
Cr-1639	Apples
Cuprocide	Tomatoes
Dithane D-14	Potatoes, tomatoes
Dithane Z-78	Apples, cucumbers, potatoes, tomatoes
Dow 9B	Gladiolus
Dowicide B	Gladiolus
F-629	Tomatoes
F-308	Tomatoes
Fermate	Apples, cucumbers
$HgCl_2$	Gladiolus
HL 331	Apples
In 10425	Tomatoes
Karbam	Apples
Lysol	Gladiolus
Mercurated lead arsenate	Apples
Methasan	Tomatoes
Mn carbamate	Apples, tomatoes
Parzate	Apples, cucumbers, gladiolus, potatoes, tomatoes
Phygon	Apples
Phygon XL	Apples, tomatoes
Puratized	Apples, gladiolus
Stanofide	Apples
Sulfurs, various	Apples, cucumbers
Tribasic	Cucumbers, potatoes, tomatoes
Tribasic A	Tomatoes
Zac	Apples, tomatoes
Zerlate	Cucumbers, potatoes, tomatoes

REPORT OF THE SECTION ON FUNGICIDE TESTS FOR THE CONTROL OF APPLE DISEASES, 1948

J. M. Hamilton

Early in the season of 1948, a letter was circularized to twenty-five potential cooperators stating that there would be no cooperative effort suggested for the year but that the results of their experiments would be compiled at the end of the season. The data of fourteen are reported. The comments are given of six others who, for reasons beyond their control, did not have fruit counts. While some of the reports given might well be summarized, it was thought that they were necessary to complete the picture of what happened in 1948. The foliage data not included in this report and the comments as to injury of those who did have scab in their plots were of material value. Omissions and misinterpretations are possible. It is hoped taht the compilation with its shortcomings may be timely and useful.

The effort and good will extended by those taking part in this project are appreciated.

Cooperators

Connecticut - E. M. Stoddard and S. Rich
Delaware - J. W. Heuberger and S. H. Davis
Illinois - Dwight Powell
Indiana - J. R. Shay
Iowa - G. L. McNew and J. L. Hardy
Maine - M. T. Hilborn
Maryland - J. C. Dunegan and M. C. Goldsworthy
Massachusetts - O. C. Boyd
Michigan - Walter Toenjes and A. E. Mitchell
Missouri - H. G. Swartwout
New Hampshire - M. C. Richards and E. J. Rasmussen
New Jersey - R. H. Daines
New York - J. M. Hamilton
D. H. Palmiter
North Carolina - C. N. Clayton
Nova Scotia - J. F. Hockey
Ohio - H. C. Young and H. F. Winter
Ontario - G. C. Chamberlain
Pennsylvania - H. W. Thurston and W. A. Chandler
Virginia - A. B. Groves
West Virginia - C. F. Taylor
Wisconsin - J. Duain Moore

Table 1. Fungicide test on Golden Delicious at Urbana, Illinois, 1948. Dwight Powell.

Treatment	Per cent Scab on Fruit 6/24	7/16	10/20
Magnetic "70" 8-100	21	23	38
Fermate 1 1/2-100	7	15	20
Manganese carbamate 1 1/2-100	5	12	30
341C 1 1/2 pt.-100	16	28	51
Bioquin 50W 1-100	7	16	36
Bioquin I, 1/4 + Sulfur 3-100	4	9	16
Puratized 1 pt. -100	4	7	14
Stanofide 1/2 pt. -100	20	20	42
Unsprayed	36	46	89
L. S. D. at 5% level	16.	19.	20.

Six applications of treatments were made, pre-pink through 2nd cover. Lead arsenate 3-100 was used in the calyx and two covers. Lime 3-100 was used with the lead except in the Fermate and Puratized.

Comments:

1. Puratized was the best treatment throughout the season.
2. Fermate allowed serious foliage infection.
3. Manganese carbamate gave cleaner foliage than Fermate but some injury.
4. None of the treatments caused fruit injury.

Table 2. Fungicide test on apples, Barr Orchard, Lake Cicott, Indiana, 1948. J. R. Shay.

Treatment*	Per cent Scab on Fruit at Harvest: McIntosh	Grimes	Golden Delicious	Gallia Beauty	Average
Wettable Sulfur 6-100	51	19	37	40	38
Bioquin 50W 1-100	36	38	32	36	35
Phygon XL 3-100	32	23	41	34	32
341C 1 1/2 pt. -100	12	8	11	12	11
Puratized 1 pt. -100	46	20	--	44	36
Fermate 1 1/2 -100	38	24	--	25	28
Manganese carbamate 1 1/2	36	15	--	29	27

*Seven applications as follows: Delayed dormant, pre-pink, bloom, calyx, and 1st, 2nd and 3rd covers. Supplemental sprays include overall wettable sulfur spray in early bloom, and four sprays of 341C at 2-week intervals following 3rd cover.

Lead arsenate and lime were used in calyx and 3 cover sprays.

Fungus and weather conditions:

1. First scab lesions observed May 2 from an infection period of 2 days immediately preceding delayed dormant application, April 15.
2. Dry weather prevailed between delayed dormant and early bloom.
3. Six wetting periods, ranging from 16 to 55 hours each, occurred between early bloom (May 2) and calyx (May 14). Moderate to heavy ascospore discharge and presence of scattered primary lesions during these wet periods resulted in very heavy infection.
4. Dry weather prevailed from calyx until June 6. Practically no spread of disease occurred after mid-June.

Comments:

1. Test rated as poor since protection during the critical late bloom period is all that can be measured.
2. Performance of 341C under these conditions is outstanding.
3. No undesirable effects from four summer applications of 341C noted on fruit. Leaf spotting developed on all varieties as a result of not adding lime to the 341C.

Table 3. Fungicide test on McIntosh in Maine, 1948. M. T. Hilborn.

Sprays applied after infection periods.

Treatment	Per cent Scab on Fruit
Block A	
Mike 8-100	8
Lime Sulfur 8-100 (Mike 8 in covers)	7
Puratized 1 pt. -100 (" " ")	9
Phygon 3/4-100	1
Unsprayed	100
Block B	
Micronized 8-100	4
Good-rite z.a.c. 2-100	3
CR-1639 2-100	5
Bioquin 50W 1-100	1
" " 1/2 + Micronized 4-100	T
Phygon 1/2 + Micronized 4-100	1
" 1/2 + Fermate 1/2-100	1
Unsprayed	64
Block C	
Puratized 1/2 pt. + Fermate 1/2 (Fermate 1 1/2 in covers)	3
Puratized 1/2 pt. + Mike 4 (Mike 8 in covers)	7
Puratized 1/2 pt. + Phygon 1/2 (Phygon 1/2 in covers)	10
Puratized 1/2 pt. + Bioquin 50W 1/2 (B50W 1 in covers)	23

Eight applications were made, 4 pre-bloom, a petal-fall, and 3 cover sprays. Three of the pre-bloom sprays were applied after wetting of 76, 45, and 91 hours.

Fungus and weather conditions:

1. Scab potential high for Blocks A and C, low for B.
2. Six infection periods May 7 to June 5.
3. Scab lesions first observed June 22.

Comments:

1. Test rated good for A and fair for B and C.
2. Phygon caused some foliage mottling in last cover spray.
3. No differences were detected in fruit color and size.

Table 4. Fungicide test on McIntosh at Durham, New Hampshire; 1948. M. C. Richards, E. J. Rasmussen, and Francis Racine.

Treatment	Block A Per cent Scab	Block A Per cent Russet	Block B Per cent Scab	Block B Per cent Russet
Micronized 6-100	1	3	1	11
Puratized 1 pt.-100*	1	7	2	15
Fermate 1 1/2-100	4	25	3	29
Phygon XL 3/4-100	1	18	1	10**
Sulfur 3 + Phygon 1/2-100	1	8	1	16**
Fermate 3/4 + Phygon 1/2-100	2	18	1	23**
" " + Manganese carbamate 1/2-100	1	7	4	6
Sulfur 3 + Manganese carbamate 1/2-100	-	-	1	6
Unsprayed	-	-	100	-

*Phygon XL in the 2nd cover spray.
**No Phygon in the calyx or 1st cover sprays.

Seven applications were made between early pre-pink and 2nd cover. Arsenate of lead 2-100 with DDT 2-100 was added in the 1st cover and the DDT was used alone in the 2nd cover.

Fungus and weather conditions:

1. There were 10 infection periods. Block A had one between each of the first 4 sprays, 3 between early bloom and petal-fall, 2 between petal-fall and first cover, and 2 between 1st and 2nd covers. Block B had approximately 2 between each application.
2. First scab appeared May 27 (mid-bloom).

Comments:

1. Severe frost damage to foliage in early season, trees in low vigor, and latter part of season dry.

2. Moderate to severe injury in Phygon plots.
3. There was an increase in Phygon injury to fruits with sulfur or Fermate mixtures.
4. Fermate did not give a good performance.

Table 5. Fungicide test on Delicious in New Jersey, 1948. R. H. Daines.

Treatment	Per cent Scab on Fruit
Lime Sulfur 2-100*	4
Micronized 6-100	4
" 3 1/2 + Fermate 1/2-100	4
Fermate 1 1/2-100	4
Manganese carbamate 1 1/2-100	3
Copper 8 1-100	3
341C 1 1/2 pt.-100	4
Puratized 1 pt.-100	1
HL331 1/2 pt.-100	1
Phygon 3/4-100	2
Unsprayed	100

*Micronized sulfur replaced lime sulfur during 4th cover spray. Fermate replaced sulfur sprays in 5th cover.

Three pre-bloom, a petal-fall, and 5 cover sprays were applied. All sprays applied on 7-day schedule through 2nd cover. Potential inoculum was high. Remaining 3 covers applied on 10-day schedule. Arsenate of lead used in petal-fall and 1st cover applications. DDT used in remaining cover sprays.

An infection period occurred at the squirrel's ear stage and eight during the time that cover sprays were used. The wet periods were distributed quite evenly through the cover period.

Comments:

1. Organic mercury fungicides caused some yellow leaves following the 3rd, 4th, and 5th cover sprays.
2. Phygon seemed to affect fruit set adversely.
3. The 341C and Phygon caused 12 and 33 per cent fruit russet, respectively.

Table 6. Fungicide test on McIntosh, Brownlee Orchard, Geneva, New York, 1948. J. M. Hamilton.

Treatment	Per cent Scab on Fruit
Block A	
Micronized 5-100	39
" 8-100	38
Everett Flotation Sulfur Paste 10-100	33
" " " " 6 + p.e.p.s. 1/2-100	45
Magnetic "70" 7-100	26
Flo-Sul "70" 7-100	74
G.L.F. #4 5-100	55
Magnetic "95" 5-100	55
Mike 5-100	66
Fermate 1 1/2-100	5
Unsprayed	100

Nine applications made between pre-pink (April 27) and 4th cover (August 4). Bordo-oil and Puratized applied in green-tip and delayed dormant, respectively. Lead 3-100 used in 4 sprays after petal-fall. No lime added. DDT put on in 2nd and 4th covers. Grasselli Spreader-sticker added in cover sprays to all but Fermate where B1956 was used.

Comments:

1. Carry-over of inoculum moderate.
2. There were 17 infection periods by August 4 with 14 inches of rain.
3. Scab observed 10 days after petal-fall (May 27).
4. Check trees heavily scabbed early in season.
5. Not much scab development after 2nd cover, July 2.
6. Everett Paste caused a yellow chlorotic type of injury. All dry wettables injured the foliage in the early sprays.
7. Two-spotted mite was serious on Fermate trees.
8. Most of scab on fruit appeared at one time. June drops had same percentage of scab as picked fruit.

Table 7. Fungicide test on McIntosh, Brownlee Orchard, Geneva, New York, 1948. J. M. Hamilton.

Block B	
Treatment	Per cent Scab on Fruit
Micronized 5-100	18 (7)*
341B 2-100	4
" " + p.e.p.s. 1/2-100	6
341C 1 1/2 pt.-100	2
" " + Lime 3-100	8
Good-rite z.a.c. 1/2 + p.e.p.s. 1/2-100	38
Z78 1-100	33
Fermate 1 1/2-100	5
CR-1639 1 1/2 pt.-100	15
Unsprayed	100

*The micronized trees by the glyoxalidine and z.a.c. treatments had 7 per cent scab.

Eight applications made between pre-pink and 2nd cover. Bordo-oil and Puratized applied in green-tip and delayed dormant, respectively. Micronized put on whole block in 4th cover. Lead 3-100 used in 5 sprays following bloom. Lime 3-100 used except in 341C alone and carbamates. DDT applied in 4th cover.

Comments:

1-5. Same as for Brownlee sulfur Block A.
6. The 341C alone caused more russet than 341C with lime but this was not apparent at harvest.
7. Fruit sprayed with 341C scalded as did those with sulfur.
8. The foliage of the micronized and 341B plots had more scab than that of 341C.
9. CR-1639 caused severe injury prior to the cover sprays.
10. CR-1639 not compatible with Z78.

Table 8. Fungicide test on McIntosh, Brownlee Orchard, Geneva, New York, 1948. J. M. Hamilton.

Sprays delayed until infection periods occurred.

Treatment	Per cent Scab on Fruit	
	McIntosh	Cortland
Bioquin 50W 1-100	31	16
" " " + p.e.p.s. 1/2	13	9
Puratized A 1 pt.-100	26	20
Puratized B 1 pt.-100	4	2
HL331 1/2 pt.-100	6	3
" 1/4 pt. + Micronized 3-100	6	5
Puratized A 1/2 pt. + " "	15	16
Phygon XL 1/2-100	23	20
" 1-100	8	10
Phygon XL-CS 1/2-100	40	47
" " 1-100	8	10
" " 1/4 + Micronized 3-100	26	16
" " 1/4 + Fermate 3/4-100	14	10
Fermate 1 1/2-100	21	15
" 3/4 + Manganese carbamate 3/4-100	10	12
Micronized 3-100	67	71
" 6-100	47	39
Unsprayed	100	100

Five applications of treatments, pink to 1st cover, applied <u>after infection periods of 40, 33, 35, 52, and 50 hours.</u>

Bordo-oil and Puratized put on at green-tip and delayed dorment, respectively. Micronized 3-100 used in 2nd and 4th covers. Lead 3-100 added in 5 sprays after bloom. Lime 3-100 was included in all but the carbamates. DDT substituted in 4th cover. Phygon XL-CS is Phygon XL with calcium sulphate.

Comments:

1. Good test - moderate carry-over of scab.
2. Two applications saved by waiting for infection periods.
3. Fifteen infection periods with 10 inches of rain to 2nd cover, July 8
4. Scab observed 10 days after petal-fall (May 27). Checks heavily scabbed early - little scab development after 2nd cover.
5. Foliage of Puratized B looked tough at 1st cover. Yellow cluster leaves on HL331 trees.
6. Moderate mottling of foliage and bursting of terminal buds with Phygon.
7. Scab lesions appeared on the foliage of Phygon and phenyl mercury materials July 1 but did not sporulate.

Table 9. Fungicide test on McIntosh, Station Orchard, Geneva, New York, 1948. J. M. Hamilton.

Sprays delayed until infection periods occurred.

Treatment	Per cent Scab on Fruit
Puratized 1/2 pt.-100	29
" 1 pt.-100	18
Puratized 1/2 pt. + Micronized 3-100	21
" 1 pt. + " "	8
HL331 1/2 pt.-100	2
" " + Micronized 3-100	1
" " + Micronized 6-100	1
Micronized 3-100	58
" 6-100	22

Five applications made between pre-pink and 1st cover after infection periods of 62, 33±, 61+, 56, and 50 hours. Lime sulfur 1-50 put on early delayed dormant and Fermate 1 1/2-100 in 2nd cover. Four applications of lead 3-100 with no lime made after bloom. DDT used in last spray.

Comments:

1. Good test - moderate carry-over of scab.
2. The 5 applications cover the primary infection period.
3. Fifteen infection periods with 9.6 inches of rain to 2nd cover, July 6.
4. Scab was heavy on sulfur foliage and light on Puratized. HL331 foliage was clean.
5. The Puratized and HL331 without lime in this block had cleaner foliage than with lime in the Brownlee block.
6. Injury characterized by rings of russet did occur but was not serious.

Table 10. Fungicide test on apples, McKiernan Orchard, Rock City, New York, 1948. D. H. Palmiter.

Treatment	Per cent Scab on Fruit McIntosh	Cortland	Delicious
40% Flotation Sulfur Paste 10-100 ..	44	--	--
60% " " " 7-100......	46	--	--
Micronized Sulfur 5-100	22	10	16
Micronized 5 + p.e.p.s. 1/2-100	26	--	--
Puratized A.S. 1 pt.-100*	12	8	11
Puratized B 1 pt.-100*	26	24	15
HL331 1/2 pt.-100*...................	7	4	1
Fermate 1 1/2-100	7	--	--
" 3/4 + Phygon (1947) 1/4-100**	4	4	0

	Per cent Quince Rust Cortland	Delicious
Micronized Sulfur 5-100	6	9
Puratized A.S. 1 pt.-100*	5	22
Puratized B 1 pt.-100*	7	20
HL331 1/2 pt.-100*	3	11
Fermate 3/4 + Phygon (1947) 1/4-100**	0	0

*Micronized sulfur substituted for organic fungicide in the cover applications.

**Phygon omitted in the cover applications and Fermate used at 1 1/2-100. Lead arsenate 3-100 used without lime from calyx to 4th cover.

Ten applications were made between delayed dormant and 4th cover.

Comments:

1. Carry-over of inoculum was heavy.
2. Test rated as good. There were 14 infection periods with a total of 14.8 inches of rain.
3. No secondary infection due to dry weather after June.
4. Sulfur plots showed considerable sunscald and marginal leaf injury. General yellowing of the foliage of the sulfur-sprayed trees was in contrast with the greener foliage of the trees sprayed with organic fungicides.
5. Some marginal leaf injury from the use of lead arsenate without lime in plots sprayed with the organic mercury fungicides.

Table 11. Fungicide test on McIntosh, Harris Orchard, Poughkeepsie, New York, 1948. D. H. Palmiter.

Treatment	Per cent Scab on Fruit
Micronized Sulfur 6-100	21
Micronized 3 + Parzate 1-100	5
" 3 + Z78 1-100	5
" 3 + Karbam 1-100	4
" 3 + Manganese carbamate 1-100	5
" 4 3/4 + Phygon (1947) 1/4-100	2
" 5 + p.e.p.s. 1/2-100	16

Nine applications between delayed dormant and 3rd cover. Sulfur on all plots in 4th cover. Lead was used without lime from petal-fall through 1st cover (4 sprays). DDT was substituted in the next 4 covers.

Comments:

1. Carry-over of inoculum was abundant and test good.
2. There were 17 infection periods with 12.2 inches of rain.
3. Scab was first seen on spur leaves at bloom.
4. Check trees had dropped all fruit and most leaves by 1st cover.
5. No secondary infection occurred due to dry weather after 2nd cover.
6. The Phygon-sulfur plots looked good early in the season but showed browning of the foliage with hot weather. Fruits were small, of poor color, and dropped early.
7. The Parzate-sulfur mixture caused severe fruit russet (June 15). The Z78-sulfur mixture caused an occasional russeted fruit.
8. Both the iron and manganese carbamate-sulfur combinations looked good with little injury and the best fruit color.

Table 12. Fungicide test on McIntosh, Zimmer Orchard, Poughkeepsie, New York, 1948. D. H. Palmiter.

Treatment	Per cent Scab on Fruit
Flotation Sulfur Paste 10-100*	13
Puratized 1 pt.-100**	5
" 1/2 pt. + Fermate 1/2-100**	3
Fermate 1 1/2-100	3
" 3/4 + Phygon (1947) 1/4-100	4
Bioquin 50W 1-100	12
Manganese carbamate 1 1/2-100	28

*Dry lime sulfur used to burn out scab lesions at first cover, June 4.
**Fermate 1 1/2-100 was substituted after 1st cover 18 days after petal-fall.

Seven applications made between pre-pink, April 23, and 2nd cover, June 28. Dry L-S or Puratized 806 applied in delayed dormant. Lead used from petal-fall through 1st cover (4 sprays) and DDT in 2nd to to 5th covers.

Comments:

1. Carry-over of inoculum was moderate and test good.

2. There were 17 infection periods with 15.2 inches of rain.
3. Scab was first observed just before bloom.
4. Check trees had dropped all fruit and many leaves by 1st cover.
5. No secondary infection due to dry weather after 2nd cover.
6. Puratized trees matured fruit later than the rest.
7. Everett Flotation Paste caused yellow foliage and sunscald.
8. Foliage of Phygon-sprayed trees turned brown during hot dry weather before other materials.
9. Bioquin 50W caused severe russet injury on fruit.
10. Heavy fruit drop occurred on the Manganese-carbamate and Phygon-Fermate plots.
11. Parzate was discontinued after the 10-day spray, May 27, due to severe fruit russet and poor scab control.
12. CR-1639 emulsion (1 1/2 pt.-100) or powder (2-100) caused both fruit and leaf injury. The powder at 1-100 with Fermate 3/4-100 was used after bloom without injury.

Table 13. Fungicide test on apples, Kentville, Nova Scotia, Canada, 1948. J. F. Hockey.

Treatment (Imperial Gallon)	Per cent Scab on Fruit
Crimson Gravenstein	
Fermate 1 3/4-100	12
Flotation Sulfur 15-100	13
Sulforon X 8-100	19
341C 1 3/4-100	11
Phygon 1-100	20
Mercurated Lead Arsenate 2 1/2-100	46
McIntosh	
Fermate 1 3/4-100	43
Lime Sulfur 1 1/2 gal. + Iron Sulfate 6-100	11
341C 1 3/4 pt.-100	45
Phygon 1-100	40

Fungus and weather conditions:

1. Rainfall was 10.4 inches for May and June. A 54-hour infection period at 60°F. occurred at the start of bloom and a 76-hour infection period just before petal-fall. There were many wetting periods of 15 to 20 hours.
2. Foliage scab was first observed as the trees came into bloom.

Comments:

1. Test was not completely satisfactory as there was too much variation between count trees. Spraying conditions were difficult.
2. Red mite and oyster shell scale were present on fruit from the

Phygon plot, but none was observed on the 341C plot. There was a trace of red mite on Fermate-sprayed fruit.

3. No foliage or fruit injuries observed except a slight chlorotic flecking of the foliage on the mercurated lead arsenate plots.

Table 14. Fungicide test on Rome Beauty, Melrose Orchard, Wooster, Ohio, 1948. H. C. Young and H. F. Winter.

Treatment	Per cent Scab on Fruit
Micronized 6-100 (covers 5-100)	3
" " + p.e.p.s. 1/2 (covers 5-100 ..	2
Mike 6-100 (covers 5-100)	6
" " + p.e.p.s. 1/2 (covers 5-100)	4
Flotation 12-100* (covers 8-100)	4
" " + p.e.p.s. 1/2 (covers 8-100).	6
Magnetic "70" 8-100* (covers 5-100)	6
Good-rite z.a.c. 1 1/2 + p.e.p.s. 1/2-100	4
Fermate 1 1/2-100	8
341C 1 1/2 pt. + Lime 3-100	8
Phygon 3/4-100 (Mike 5 after 1st cover)	10
" 1/2 + p.e.p.s. 1/2 (Mike 5 after 1st cover)	7
Puratized 1 pt. -100 (" " " ")	5

*Flotation 10 and Magnetic "70" 6 1/2 were used in petal-fall.
Eight spray applications were made from the pre-pink, April 19, to July 28. Arsenate of lead was used in petal-fall and cover sprays.

Comments:

1. Test rated as fair. Scab infection primary.
2. The 341C caused foliage injury and fruit russet.
3. The z.a.c. with p.e.p.s. caused foliage injury.

Table 15. Fungicide test on McIntosh, Dominion Laboratory Orchard, St. Catharines, Ontario, Canada, 1948. G. C. Chamberlain.

Treatment (Imperial Gallon)*	Per cent Scab on Fruit
Block A	
Magnetic "95" 8-100	58
Mike 8-100	52
Mulsoid 8-100	52
Microflotox 8-100	44
" " + Orthex 1 pt. -100	29
" " + p.e.p.s. 1/2-100	27
Magnetic "70" 9-100	31
Flotation Paste 15-100	57
Fermate 2-100	13
341C 1 3/4 pt. + Lime 1-100	5
Phygon 1-100	6
HL331 1/2 pt. -100	2
Block B	
Microflotox 8-100	35
Lime Sulfur 1-60	25
Phygon 1-100	1
341C 1 3/4 pt. + Lime 1-100	3
Puratized 1 pt. -100	10
HL331 1/2 pt. -100	2
Unsprayed	100

*Block A: Three pre-bloom, one bloom, calyx, and two cover sprays were applied. Bordo 2 1/2-5-100 replaced Puratized, HL331, and lime sulfur in the 2nd cover spray. Block B: The pre-pink and pink applications, as in Block A, were omitted and two bloom sprays were followed by the cover sprays.

All plots received 2 additional cover sprays of Fermate 1-100. The dry wettable sulfurs were reduced in the cover sprays to 6-100; Magnetic "70" to 6-100; Flotation Paste to 10-100; and Fermate to 1-100.

Fungus and weather conditions:

1. Carry-over of inoculum was considered light.
2. Ascospore discharge commenced at pre-pink (April 24).
3. Important infection period occurred during repeated showers at full pink and partial bloom (May 10-14). Secondary infections took place June 7-9 and June 22-24.
4. Primary infection was observed at the calyx stage, May 28.
5. Summer weather was very dry.

Comments:

1. High incidence of scab provided a critical test. The organics were decidedly more effective than the sulfurs.

2. HL331 was outstanding in performance.
3. Compound 341C and Phygon provided excellent control. Both materials caused excessive fruit russeting. Foliage injury occurred on the Phygon trees.
4. Fermate gave only mediocre control of foliage scab but little infection develped on the fruit.

Table 16. Fungicide test on apples, State College, Pennsylvania, 1948. H. W. Thurston and W. A. Chandler.

Treatment*	Per cent Scab on Fruit McIntosh	Per cent Scab on Fruit Staymen Winesap
341C 1 1/2 pt. -100	18	6
LS 1-50 before bloom - 341C 1 pt.-100 after ..	32	10
LS 1-50 " " - Flotation 10-100 after.	31	6
Bioquin 50W 1-100	73	28
Unsprayed	100	100

*Nine applications made between delayed dormant and 4th cover. Sprayed at intervals of one week through 1st cover.

Fungus and weather conditions:
1. Two or more infection periods occurred between each spray between the pre-pink and first cover.
2. Scab appeared on spur leaves at petal-fall (May 12).

Comments:
1. Flotation caused foliage injury.
2. The 341C gave a better looking foliage than sulfur or Bioquin.
3. The 341C-sprayed foliage showed lowest red mite count.
4. Bioquin 50W gave rather poor performance.

Table 17. Fungicide test on apples, Tuttle Orchard, Stephens City, Virginia, 1948. A. B. Groves.

Treatment*	Per cent Scab York Foliage	York Fruit	Jonathan Foliage	Jonathan Fruit
Fermate 1 1/2-100	16	2	2	0
341C 1 qt. + L 1/2-100	5	2	1	0
Bioquin 50W 1-100	12	1	2	0
Phygon XL 3/4-100	1	0	T	0
Puratized 1/2 pt.**	7	2	3	0
Unsprayed	81	83	57	6

*Nine applications were made: Pre-pink, pink, petal-fall, and 6 cover sprays (first seven sprays at 14-day intervals). DDT was used in all

sprays after bloom.
**Manganese carbamate substituted for Puratized after 2nd cover.

Fungus and weather conditions:

1. Carry-over of inoculum light to moderate.
2. Major ascospore discharges occurred at pre-pink, pink, and between petal-fall and 1st cover.
3. Abundant source of conidia for secondary infection at 1st cover.
4. Rainfall was frequent during May and June.

Comment:

1. Fruit russet occurred in all plots other than those of Fermate and Puratized.

Table 18. Fungicide test on Starking in West Virginia, 1948. C. F. Taylc

Treatment	Per cent Scab	
	Foliage	Fruit
Section A		
Flotation 6 + Fermate 3/4-100*	30	16
Fermate 1 1/2-100	50	18
Phygon 3/4-100**	49	39
Phygon 3/4-100*	64	46
Puratized 1/2 pt. + Fermate 3/4-100*	43	16
Section B		
341C 1 qt.-100**	2	5
Bioquin 50W 1-100**	42	16
Micronized 6-100***	30	32
Puratized 1 pt.-100**	44	44

*Materials 4 sprays - Fermate 1 1/2 three sprays.
**Materials 6 sprays - Fermate 1 1/2 last spray.
***Micronized 6-100 in pink and calyx and 5-100 in 1st 2 covers. Bordo (1/2-2) 2 sprays and Bordo (2-4) last spray.

Seven applications between the pink and the 5th cover. The first four sprays (pink, calyx, and 2 covers) were the important sprays.

Two infection periods before treatments began. Block B same as Block A except the treatments under Block B were delayed 4 days at 1st cover, May 6 to May 10, with intervening infection.

Comments:

1. Crop light and irregular due to frost.
2. The 341C was outstanding in the control of scab.
3. Phygon caused excessive russet when used later than 2nd cover.
4. Bioquin 50W was more effective against fruit scab than against leaf scab.

Table 19. Scab control on Delicious and Stayman with a ground spray of Elgetol and a foliage spray of Puratized at petal-fall, U. S. D. A., Beltsville, Maryland, 1948. M. C. Goldsworthy and J. C. Dunegan.

Treatment*	Per cent Leaf Scab	Per cent Fruit Scab	Degree Infection
	Delicious		
Unsprayed	92.6	61.0	Heavy
Puratized 1 pt.-100	13.0	16.2	Light
	Stayman		
Unsprayed	92.8	70.0	Heavy
Puratized 1 pt.-100	22.4	2.0	Light

*All plots received ground spray of Elgetol 1/2% - 400 gallons per acre on March 30.
The Puratized 1 pt.-100 gallons was applied at petal-fall (April 22). Lead arsenate 2-100 and DDT 2-100 were used in the first 2 covers (May 4 and 17).

Comment:
1. Apple scab was very severe in the area this season and many orchards were defoliated early.

Connecticut - E. M. Stoddard and S. Rich.

They deduced from scab counts made on the foliage of Dwarf McIntosh that Phygon XL and Puratized were more effective when used alone than when used in a split schedule with Fermate. Z78 and 341C were rated as unsatisfactory for scab control. The counts did not show any appreciable value from mixing sulfur and Fermate.

Delaware - J. W. Heuberger and S. H. Davis.

In a primary leaf infection count made on Delicious, Bioquin I 1-100, Puratized 1 pt.-100, and liquid lime sulfur 1 1/2 gal.-100 were about comparable but all were inferior to Magnetic "70" 8-100. Puratized 2 pt. -100 gave the same protection as the Magnetic "70."

Iowa - G. L. McNew and J. L. Hardy.

Scab control based on the primary infection of the foliage of Jonathan and Starking indicates that Phygon XL and AL were both consistently effective even at 6/16-100. Secondary infection was consistently lowest on trees sprayed with Puratized. Puratized, Phygon XL, and dry lime sulfur were more effective than Fermate, 341B, 341C, and the wettable sulfurs.

Massachusetts - O. C. Boyd.

The fruit on all the plots were practically clean, probably due to a light carry-over of inoculum. A tighter than usual cover-spray schedule failed to prevent secondary spread of scab on leaves in the micronized plot. Secondary infection occurred in the Fermate-p.e.p.s. plot in late August. The foliage remained free of scab in the Puratized A and B, HL331, and Phygon plots.

Phygon XL caused leaf chlorosos as in 1947. Puratized B stunted the leaves, causing the trees to look thin or scanty of foliage. Fruit set was distinctly lighter in the Phygon plots than for the other materials. The bestlooking foliage and fruit occurred in the micronized and Fermate rows.

The least fruit russet occurred in the micronized 6-100 and Fermate 1 1/2-p.e.p.s. 1/2-100 plots and the most in those of the Phygon XL (3/4-100) and Puratized B (1 pt.-100). Magnesium sulfate reduced Phygon chlorosis in leaves and russet on fruit. HL331 (1/2 pt.) and Puratized (1 pt.) caused only slightly more russet than micronized and Fermate.

Missouri - H. G. Swartwout.

The season of 1948 was such that little scab developed. Delicious, Jonathan, and Ben Davis sprayed with arsenate of lead in the calyx, first cover, and second cover were almost free of sooty blotch and fly speck at harvest time, while those sprayed with DDT were heavily infected with the diseases. Trees sprayed in the pre-pink, pink, and calyx periods with Puratized 1 pt. had considerably less of these two diseases than trees which received wettable sulfur in these same applications.

Virginia - A. B. Groves.

Compatibility of some organic fungicides and insecticides:

(a) Scab Control:

Fermate. The fungicidal effectiveness of Fermate was reduced by Parathion and Neotran, was unaffected by IN-4200, and was fortified by DN-111.

Phygon. Scab control was good in all plots with probably significant reduction in effectiveness by Neotran. Injury was so severe, however, that this consideration was unimportant.

Puratized. It was not seriously affected by any combination although scab control was poorer when used with IN-4200.

Manganese carbamate. It did not hold secondary scab satisfactorily. Parathion reduced its effectiveness.

Bioquin 50W. Scab control with Bioquin was significantly reduced by Neotran and DN-111.

Compound 341C. Effectiveness against scab was reduced by Neotran and improved by IN-4200 and DN-111. This latter effect may have been due to a shock effect with appreciable loss of foliage.

(b) Safety:

Fermate. No injury occurred when Fermate was used in combination with Parathion, Neotran, or DN-111. Injury with IN-4200 was severe, as it was in all plots where it was used.

Phygon. Some typical Phygon spotting occurred in all plots but it was not serious. All miticides caused a significant increase in fruit injury, least with Parathion.

Puratized. All injuries where this material was used were attributable to the miticide. There was a noticeable development of yellow leaves early in the summer where Puratized was used, but no count was made as the trouble did not reappear after these first affected leaves fell.

Manganese carbamate. It did not appear injurious in any miticide combinations or alone.

Bioquin 50W. Jonathan were seriously russeted when Bioquin 50W was used in an all-season schedule, in all combinations and alone. Injury on the York was less severe. It was most aggravated by Parathion and Neotran.

Compound 341C. Produced some injury when used alone and was not significantly affected by Parathion or DN-111. Injury was severe with Neotran and IN-4200.

Wisconsin - J. Duain Moore.

There was no difference between treatments in tests on McIntosh. An objectionable amount of leaf injury occurred on the 341C plots. The trees sprayed with Phygon in 1947 failed to develop fruit buds for the 1948 season.

Conclusions

Wettable sulfurs, as a group, gave poor control of apple scab, particularly in comparison with the organics. This is attributed to insufficient retention and poor timing or lack of protection at the critical infection periods. Magnetic "70" was the most effective. Comparatively high concentrations or the addition of stickers did not sufficiently improve the scab control. The performance of p.e.p.s. was inconsistent and in no instance outstanding. The mixture of sulfur with a carbamate, Phygon, or phenyl mercury compound has definite possibilities. Wettable sulfurs were effective if the carry-over of inoculum was small, the variety resistant, the timing good, or the test was not otherwise critical, as indicated by low check counts.

Fermate, in general, was decidedly more effective than the wettable sulfurs, which is difficult to explain. This is the first year in which this has occurred. As in previous years, it gave better control of scab on the fruit than on the foliage. The addition of Fermate to Puratized and Phygon increased their protective function. Fermate materially reduced the effectiveness of Puratized and HL331 and, to some extent, that of Phygon, when the mixtures were applied after infection periods. It did act as an arsenical corrective when added to Puratized. The mixture of Fermate and Phygon appears to be the safest way to use Phygon but applications should not be made in the cover sprays. Manganese bis dithiocarbamate is probably somewhat inferior to Fermate in scab control, but the data are not entirely consistent. The mixture of this material with Fermate is of questionable value. Parzate caused severe injury to the fruit. Two-spotted mite was serious on the carbamate, Phygon, and Bioquin 50W trees. Good-rite z.a.c. has given indication of warranting field tests but, unfortunately, none of the experiments in 1948 showed its possibilities. It is thought that the formula in 1948 was such as to give poor retention.

Bioquin 50W at 1-100 was not adequate for scab control in critical tests although it was much improved with the addition of a sticker. It will not be available for further testing. Severe injury occurred when lime was omitted.

The Compound 341C gave remarkably good scab control in most critical tests although, for some reason, it was not effective in others. There were instances of foliage injury and severe fruit russet. Scab control was obtained without the addition of lime. There is indication that it might control red mite. The 341B can be considered to give adequate conditions.

Phygon 1/2-100 was not strong enough to control scab except under favorable conditions. Evidently, Phygon 1-100 was not too effective when it functioned as a protectant under considerable rainfall. Phygon, not unlike Puratized, gave better scab control when the rainfall was low or when applied after infection periods. There is something to be said for the addition of Phygon one-half strength to wettable sulfur or, perhaps better yet, Fermate when the applications are made after wetting periods. One cannot expect maximum results with any of the materials after lengthy wetting periods, except at full strength. Phygon caused too much foliage injury and there were instances of rather severe russeting of the fruit. Fruit drop was serious with late applications. Phygon caused the terminal buds to prematurely burst. Trees sprayed with it in 1947 in Wisconsin and New York failed to bear a crop of fruit in 1948. Even if a corrective that would eliminate injury were found, there might be some question as to the effectiveness of Phygon when applied after wetting periods. Phygon did not have a good year in 1948.

Puratized Agricultural Spray is not a good protectant, but it may be expected to give fair results when applied after infection periods. Lesions may become visible and not bear conidia. Puratized is most effective when mixed with sulfur and Fermate, but the latter may not control scab when applied after lengthy wetting periods. Puratized B was more effective than the Puratized A in one instance but less in another. It is more injurious.

HL331 (Tag Fungicide No. 331) gave the most consistent performance of any of the materials considered when applied after infection periods. It was reasonably compatible with most materials. It appeared to be more effective than Puratized against quince rust. Some injury occurred on fruit and foliage but this is not considered a serious factor at this time. HL331 would appear to be the most promising material of 1948.

CR-1639 (emulsion) was definitely fungicidal, but it caused too much injury, particularly when applied before the cover sprays. The dry form was safer, but the indication it that it is not as effective, particularly when applied after wetting periods.

Scab control obtained on Delicious and Stayman with a ground spray of Elgetol and a foliage spray of Puratized at petal-fall suggested possibilities for such a combined program. It could be said that the application of Puratized was fortunately at a most critical time.

REPORT OF THE NATIONAL CUCURBIT FUNGICIDE TEST--1948

J. W. Heuberger

The following plant pathologists cooperated in the test on the following crops:

Cooperators	State	Crops
J. G. Atkins	Louisiana	Cucumbers
C. E. Cox	Maryland	Cantaloupes
D. J. deZeeuw	Michigan	Cucumbers and Cantaloupes
D. E. Ellis	North Carolina	Cantaloupes and Watermelons
W. M. Epps	South Carolina	Cucumbers
J. W. Heuberger	Delaware	Cucumbers and Cantaloupes
J. D. Wilson	Ohio	Cucumbers and Cantaloupes

The test fungicides are listed below. Several cooperators also reported on other materials:

Material	Spray	Dust
Tribasic	3(4)-100	10% Tribasic
Zerlate	2-100	8% Zerlate
Parzate	2-100	8% Parzate
Dithane Z-78	2-100	8% Dithane Z-78

Cucumbers for Pickles

Reports were received from Ohio and Delaware. The data are presented in Table 1.

Disease Control: Disease was not a factor in Ohio. In Delaware, the downy mildew disease was a factor, even though it appeared late; some anthracnose also was present in Delaware. The data from Delaware show that all materials were about equal for control of downy mildew; as regards anthracnose, the organics gave control but the coppers did not. (The amount of anthracnose present was not enough to cause defoliation).

Yield: In Delaware, Dithane Z-78 and Zerlate gave the highest yields. There were no significant differences in Ohio.

Injury: Copper A caused severe leaf injury and Parzate dwarfed the plants in Delaware. (Most of the Copper A injury followed after one of the early applications). Parzate was reported injurious in Ohio.

Table 1. National Cooperative Cucurbit Fungicide Test on Cucumbers for Pickles. 1948.

Material	Concentration	Ohio[a] (Wooster) Yield (lbs/Acre)	Delaware[b] % Defoliation	Delaware[b] Yield (lbs/Acre)	Remarks
No Fungicide		13,920	75	5,566	
Tribasic	10% dust	13,680			
ditto	3-100		30	7,637	
Copper A	10% dust	13,280			
ditto	3 1/3-100		40	4,931	Injury
Fermate	8% dust	12,960			
ditto	2-100		35	7,907	
Zerlate	8% dust	14,080			
ditto	2-100		38	8,640	
Parzate	6% dust	13,600			Injury
ditto	2-100		35	5,390	Dwarfing
Dithane Z-78	6% dust	15,200			
ditto	2-100		23	8,560	
Cu-Zn-Chromate	8% dust	16,640			
L.S.D. at 5% Level		NS		1,319	

[a] Disease not a factor in Ohio.

[b] Downy Mildew disease a factor in Delaware, although it appeared late.

Note: Applications - Ohio, not given; Delaware, eight (July 2-Aug. 18).

Table 2. National Cooperative Cucurbit Fungicide Test on Cucumbers for Slicing. 1948

Material[a]	Concentration	Michigan[b] Yield (Lbs/Plot)	Ohio[c] Anthracnose (%)	Ohio[c] Yield (Lbs/Plant)	Louisiana[d] Downy Mildew L (%)	Louisiana[d] Anthracnose (%)	Louisiana[d] Yield (Bu/A)	South Carolina[e] SC-5[f] Yield (Bu/A)	South Carolina[e] Marketer[g] Downy Mildew (%)	South Carolina[e] Marketer[g] Yield (Bu/A)	South Carolina[e] SC-5 and Palmetto[g] Average Yield (Bu/A)
No fungicide		63.9	6.1	4.83				165			
Tribasic	10% Dust		7.0	5.17	6.2	1.3	231	149	84	54	161
ditto	3-100	53.3							78	56	163
Zerlate	8% Dust		5.6	5.40	9.4	1.4	219	136	83	48	152
ditto	2-100	54.7							73	72	164
Parzate	8% Dust		4.5	5.66	8.1	0.2	195	176	93	24	155
ditto	2-100	50.4							88	39	154
Dithane Z-78	8% Dust		5.00	4.7	6.7	0.03	241	174	63	54	168
ditto	2-100	65.3							62	92	179
Fermate	8% Dust		7.8	4.80	8.8	0.06	168				
L.S.D. at 5% Level		NS		NS	NS		34	27		22	

[a] Applications: -- Michigan (4), July 20 - Aug.16; Louisiana, (15), Aug. 31 - Oct. 19; South Carolina (10), Aug. 28 - Oct. 19.

[b] No disease.

[c] Anthracnose appeared late. Not a factor in yield.

[d] Anthracnose appeared early early but then disappeared.

[e] Downy Mildew not severe on SC-5 and Palmetto varieties (mildew resistant) but very severe on Marketer variety. Disease reading on Marketer made on Oct.20. (Author's Note: Foliage went down rapidly after Oct.5. A reading should have been made about Oct. 10-12 to get best indication of differences).

[f] Test No. 1.

[g] Test No. 2. Marketer, SC-5, and Palmetto varieties planted side by side in this test. The yield of the SC-5 and Palmetto varieties is the average yield for both varieties.

Table 3. National Cooperative Cucurbit Fungicide Test on Cantaloupes. 1948.

Treatment[a]	Concentration	Ohio[b] Defol. (%)	Ohio[b] Yield No/A	Mich.[c] Yield	Mich.[c] Defol. (%)	N. C.[d] Yield (No/A)	N. C.[d] Defol. (%)	Md.[e] Yield (No/A)	Md.[e] Soluble Solids (%)	Del.[f] Defol. (%)	Del.[f] Yield (No/A)
No Fungicide				34	80	3965	69	5127	8.7	50	5110
Bordeaux	6-3-100[g]						28	2677	7.7	8	4365
Tribasic	10% Dust	33	7830		46	3311				15	5075
ditto	3-100			35			46	4810	9.1	3	4615
Copper A	10% Dust	25	7630							10	4990
ditto	3 1/3-100									8	4465
Fermate	8% Dust	30	7970								
ditto	2-100									3	5090
Zerlate	8% Dust	23	9100		42	3003				10	4950
ditto	2-100			39			46	5218	9.4	18	4850
Parzate	8% Dust	40	7000		42	2887				13	4850
ditto	2-100			35			46	4220	8.5	10	5025
Dithane Z-78	8% Dust	27	8370		37	3080				10	4740
ditto	2-100			27			31	5445	9.1	5	5050
L.S.D. at 5% Level			NS	NS	10.3	NS		625			619

[a]Applications: -- Mich. (7), July 20-Sept.13; N. C. (8), June 17-Aug.11;
Md. (6), July 1-Aug. 18; Del. (8), July 2-Aug. 18.

[b]Defoliation mainly due to phytotoxicity and some Macrosporium.

[c]Mich. yield is No. of Cantaloupes per plot (Hales Best). No disease of any consequence.

[d]N. C. yield is No. of Cantaloupes per acre. (Hales Best No. 36). Defoliation mainly by Downy Mildew. Disease appeared too late to affect yield; last dust application made after harvest season was over to obtain control data.

[e]Md. yield is No. of Cantaloupes per acre (Hales Best "Jumbo"). Defoliation due to Macrosporium.

[f]Del. yield is No. of Cantaloupes per acre. (Hales Best "Jumbo") Defoliation due to Macrosporium.

[g]Bordeaux used at 8-8-100 in Md.

Table 4. National Cooperative Cucurbit Fungicide Test on Watermelons. North Carolina - 1948. (Blacklee Variety)

Material	Concen-tration	Downy Mildew & Anthracnose[a] % Defoliation	No. Fruit Per Acre Marketable	Total
No Fungicide		93	1,347	1,906
Tribasic	5% Cu Dust	59	828	1,309
Tribasic + Sulfur	5-85 Dust	44	1,174	1,771
Zerlate	8% Dust	29	1,309	1,906
Parzate	8% Dust	37	1,097	1,809
L.S.D. at 5% Level		7.4	344	468

[a] Anthracnose appeared early but developed slowly. Downy Mildew appeared very late. Neither disease appeared to affect yields. Disease reading taken after harvest had been completed.

Note: Ten dust applications, June 8-Aug. 11.

Cucumbers for Slicing

Reports were received from Ohio, Louisiana, Michigan, and South Carolina. The data are presented in Table 2.

Disease Control: There was no disease in Michigan. Ohio had a light dose of anthracnose which did not affect yield. In Louisiana, downy mildew was severe in untreated fields and some was present in the test plots; some anthracnose was also present. In South Carolina there was no disease on the SC-5 variety (downy mildew resistant) but downy mildew was severe on the Marketer variety.

Data on control show, in general, that the organics were better than the coppers for anthracnose control and as good as the coppers for downy mildew control. Sprays gave better control than dusts.

Yield: There was little difference in yields in Michigan and Ohio. In Louisiana, Dithane Z-78 and Tribasic gave the highest yields. In South Carolina, on the SC-5 variety, Zerlate, Parzate, and Dithane Z-78 gave higher yields than Tribasic; on the Marketer variety, Dithane Z-78 gave the highest yield, followed by Zerlate. Sprays gave higher yields than dusts.

Injury: Parzate stunted the plants in Ohio. In Louisiana, plots dusted with Parzate and Zerlate lacked vigor and showed evidence of injury, whereas plots dusted with Tribasic and Dithane Z-78 were vigorous. In South Carolina, Dithane Z-78 and Zerlate were the safest materials and Parzate the most injurious. No injury of consequence was noted in Michigan.

Cantaloupes

Reports were received from Ohio, Michigan, North Carolina, Maryland, and Delaware. The data are presented in Table 3.

Disease Control: There was no disease of any consequence in Michigan. In Ohio, some *Macrosporium* leaf spot appeared late; all materials gave about equal control. In North Carolina, downy mildew appeared too late to affect yields and dusting had to be continued beyond the harvest period to obtain control data-- all the materials gave about equal control. In Maryland, *Macrosporium* became fairly serious and Bordeaux and Dithane Z-78 gave the best control. In Delaware, *Macrosporium* was also a factor but it was not as serious as in Maryland-- all the materials gave about the same control.

Yield: In Ohio, Michigan, and North Carolina there was no significant difference. However, it is of interest to note that Parzate gave low yield in Ohio and North Carolina, whereas Dithane Z-78 gave low yield in Michigan. In Maryland, Bordeaux and Parzate significantly reduced the yield; Dithane Z-78 gave the highest yield, but the increase was not significant over the untreated. Data from Maryland on percent Soluble Solids shows that Bordeaux caused a reduction. In Delaware, Bordeaux significantly reduced the yield; no material increased yield.

Injury: There was no injury in Michigan except some marginal chlorosis from Tribasic. In Ohio, Parzate was toxic. No injury was mentioned in North Carolina. In Maryland, Bordeaux and Parzate was injurious. Bordeaux was also injurious in Delaware.

Watermelons

A report was received from North Carolina. The data are presented in Table 4.

Disease Control: Anthracnose appeared early but developed slowly. Downy mildew appeared very late. Neither disease appeared to appreciably affect yields. Dusting was continued beyond the harvest season to obtain control data. Zerlate and Tribasic + Sulfur gave the best control--Tribasic alone gave the poorest control.

Yield: Tribasic significantly reduced the yield. No treatment increased the yield.

Injury: Cooperator's note: "The earliness and frequency of dust applications may partially explain why Tribasic apparently caused a reduction in yield".

GENERAL SUMMARY

The 1948 season, on the whole, was a year of light disease attack on cucurbits. Downy mildew disease was of little consequence except on cucumbers in South Carolina, Louisiana, and Delaware. Anthracnose disease was present in small amounts in Ohio, Louisiana, North Carolina, and Delaware. *Macrosporium* leaf spot disease was serious in Maryland, and to a less extent in Delaware, on cantaloupes.

Although the data are not significant, the zinc dithiocarbamate fungicides gave better control of anthracnose disease than did the copper fungicides.

As regards downy mildew disease, the 1948 data are in line with those obtained in 1947 showing that the zinc dithiocarbamate fungicides are effective in control.

More data are required on the control of *Macrosporium* leaf spot disease.

Dithane Z-78 and Parzate, containing the same toxicant (zinc ethylene bisdithiocarbamate), reacted differently. Dithane Z-78 was non-injurious whereas Parzate was injurious. Also, Dithane Z-78 gave better disease control than Parzate.

Zerlate gave consistent results. Tribasic gave good results, except where applied too frequently.

Dithane Z-78 was the best material in the 1948 test, on the basis of disease control, lack of injury, and yield.

The most significant point in the 1948 data is that the zinc dithiocarbamate fungicides did not increase yield in the absence of disease.

SUMMARY OF DATA ON COOPERATIVE GLADIOLUS CORM TREATMENT EXPERIMENT FOR 1948

J. L. Forsberg

Cooperators by States:

Colorado - A. O. Simonds, Colorado A & M College, Fort Collins
Florida - R. O. Magie and H. N. Miller, Vegetable Crops Laboratory, Bradenton
Illinois - J. L. Forsberg, Natural History Survey, Urbana
Maryland - W. D. McClellan, U.S.D.A., Beltsville
Michigan - Ray Nelson, Michigan State College, East Lansing
New York - D. M. Yoder, Cornell University, Ithaca
Ohio - H. A. Runnels, Agricultural Experiment Station, Wooster
South Dakota - S. H. Edmunds, Twin Rivers Plantation, Sioux Falls

Planting stock and plot layouts: Corms and cormels of the Picardy variety furnished by members of the Kankakee County (Illinois) Gladiolus Growers Association were used by all cooperators. These corms were selected from stock in which scab, *Fusarium* rot, and *Sclerotinia* dry rot were present. All plots were laid out as randomized blocks, 6 replicates per treatment, 25 corms and 50 cormels per replicate.

Treating materials and methods: Materials were supplied by the manufacturers and distributed to all cooperators from one batch of each material. Treatments were made immediately before planting as follows:

1. New Improved Ceresan, 1 ounce plus 2 tablespoons Dreft to 3 gallons of water. Corms soaked 15 minutes; cormels 30 minutes.

2. Ceresan M, 1 ounce to 3 gallons water, no additional spreader. Corms soaked 15 minutes; cormels 30 minutes.

3. Lysol, 60 ml. to 3 gallons water, no additional spreader. Corms and cormels soaked 3 hours.

4. Arasan, applied as a dust full strength.

5. Dow 9B Wettable Seed Protectant, 4 ounces to 3 gallons water, no additional spreader. Corms soaked 15 minutes; cormels 30 minutes.

6. Dowicide B, 6 ounces to 3 gallons water, no additional spreader. Corms soaked 15 minutes; cormels 30 minutes.

7. Puratized Agricultural Spray, 45.4 ml. to 3 gallons water (1:5000 active), no additional spreader. Corms soaked 15 minutes; cormels 30 minutes.

8. Parzate, 6 ounces to 3 gallons water, no additional spreader. Corms soaked 15 minutes; cormels 30 minutes.

9. Corrosive sublimate, 11.4 grams to 3 gallons, no additional spreader. Corms and cormels soaked 2 hours.

10. Check, untreated.

Results: Records were taken on stand, flower production, total corms dug, rot-free corms, corms with *Fusarium* rot, scabby corms, weight of corms produced, and weight of cormels produced. Records on date of blooming were also taken by four of the cooperators.

Fusarium rot and bacterial scab were the only diseases of any consequence which developed in any of the plots. A few corms with *Sclerotinia* dry rot were noted in New York and South Dakota, and some *Curvularia* lesions were observed in Florida. These diseases were in such small amounts they can be disregarded in the results.

The effects of the various treatments were very pronounced in the corm plots. Differences in effectiveness of treatments were not apparent in the cormel plots. The effectiveness of the treatments in controlling *Fusarium* rot are shown best by flower production and yields of rot-free corms. These data are summarized in tables 1 and 2.

For control of *Fusarium* rot the four outstanding materials used in these experiments were Dowicide B, Dow 9B, New Improved Ceresan and Lysol. All four of these materials were effective in seven States. In South Dakota, use of New Improved Ceresan did not result in yields of flowers on rot-free corms significantly greater than those from untreated corms. Arasan, Ceresan M, Parzate and corrosive sublimate were effective in some States but not in others. Puratized Agricultural Spray was generally ineffective.

Percentages of scabby corms are shown in table 3. The amount of scab varied greatly in the different States. Corrosive sublimate reduced the amount of scab to zero in two States and appeared to be the most effective material in five others. None of the other materials were generally effective against scab.

No injury was reported as resulting from any of the treatments used in these tests.

Table 1. Average number of flowers produced per replicate.

Treatment	Colo.	Fla.	Ill.	Md.	Mich.	N.Y.	Ohio	S.D.
N. I. Ceresan	18.3	16.2	21.7	20.1	21.0	19.8	18.8	15.5
Ceresan M	18.2	16.2	17.7	20.0	19.3	20.8	20.3	13.8
Lysol	20.0	13.0	19.8	20.5	18.2	16.3	17.8	16.8
Arasan	21.5	16.5	20.0	19.6	19.5	18.7	17.8	14.3
Dow 9B	20.0	17.0	21.3	19.3	21.2	19.8	19.8	16.6
Dowicide B	19.8	15.3	22.2	18.6	20.8	18.3	16.0	17.0
Puratized Ag. Spray	14.2	15.7	16.8	18.5	18.0	16.3	17.1	15.0
Parzate	15.8	16.3	14.0	16.6	21.2	19.0	18.3	14.0
Corrosive sublimate	20.3	10.5	17.7	20.5	16.7	19.0	15.8	13.8
Untreated	10.2	9.3	10.8	18.0	16.7	14.5	16.1	12.5
LSD at 5% level	3.2	6.5	3.4	N.S.	3.2	5.2	2.9	3.7
LSD at 1% level	4.3	8.7	4.5		4.3	7.0	3.9	5.0

Table 2. Average number of rot-free corms produced per replicate.

Treatment	Colo.	Fla.	Ill.	Md.	Mich.	N.Y.	Ohio	S.D.
N. I. Ceresan	14.5	14.3	19.7	20.7	19.8	22.2	22.1	18.0
Ceresan M	13.0	10.5	15.3	18.7	15.3	21.2	20.5	17.0
Lysol	17.5	12.3	18.7	19.3	19.2	21.8	22.0	19.8
Arasan	16.5	8.8	14.8	19.7	17.2	21.0	19.6	17.3
Dow 9B	14.5	15.5	17.3	18.0	21.0	19.3	23.8	18.3
Dowicide B	15.2	12.8	20.0	18.8	21.2	19.8	24.0	20.8
Puratized A. S.	4.3	10.5	13.0	9.3	7.0	14.0	10.0	16.3
Parzate	6.5	11.8	9.8	14.5	16.3	17.7	19.5	16.8
Corrosive sublimate	12.5	10.3	17.3	13.5	9.7	18.5	12.0	19.5
Untreated	3.7	6.2	7.0	13.3	7.5	10.7	11.5	16.0
LSD at 5% level	3.2	5.2	4.8	3.7	3.9	3.7	3.5	3.3
LSD at 1% level	4.2	7.0	6.5	4.9	5.2	4.9	4.7	4.4

Table 3. Percent of corms produced scabby.

Treatment	Colo.	Fla.	Ill.	Md.	Mich.	N.Y.	Ohio	S.D.
N. I. Ceresan	25.0	6.0	7.2	25.9	47.4	87.9	25.9	27.6
Ceresan M	18.2	15.0	18.3	33.1	58.5	77.4	47.6	32.5
Lysol	33.1	8.0	15.4	56.9	69.2	71.3	50.3	55.0
Arasan	30.2	44.0	13.8	58.9	48.1	69.2	74.5	51.6
Dow 9B	36.2	9.0	21.2	50.0	56.1	66.4	33.1	54.5
Dowicide B	23.3	6.5	1.4	29.7	71.0	78.8	25.8	39.7
Puratized A.S.	10.2	6.8	21.1	21.2	17.9	63.6	7.4	49.6
Parzate	18.5	9.1	23.9	36.5	34.7	69.3	35.3	50.0
Corrosive sublimate	14.9	0.0	0.0	11.0	9.1	62.2	1.6	41.5
Untreated	14.7	5.3	19.0	44.0	28.2	73.4	35.1	32.8

COOPERATIVE TESTS OF FUNGICIDES FOR SNAPDRAGON RUST CONTROL - 1948

A. W. Dimock

During the 1948 season tests were set up at Los Angeles, Calif. (K.F. Baker), Beltsville, Md. (W.D. McClellan), Farmingdale, N.Y. (C.H. Ford), and Ithaca, N. Y. (A.W. Dimock). Parzate (2 lbs./100 gals.) and Dithane D14 plus zinc sulfate (2qts./1 lb./100 gals.) were compared at a 1 week interval and Parzate, Dithane D14 plus zinc sulfate, Dithane Z-78 (2 lbs./100 gals.), manganese ethylene bis dithiocarbamate (1.3 lbs. /100 gals.), and IN10425 plus zinc sulfate (2qts./100 gals.) at a 2-week interval. Tests the previous season had indicated that a 1-week interval would be too short for a critical comparison of highly effective materials, but the 2-week interval proved too long during the 1948 season.

Results: Both Parzate and D14 gave near-perfect control at the 1-week interval at Los Angeles, Farmingdale and Ithaca. None of the materials gave satisfactory control at the 2-week interval at Los Angeles and Ithaca, while only moderate control was obtained at Farmingdale where the disease potential was lower. Rust failed to develop at Beltsville, presumably because of excessively high summer temperatures. None of the materials gave any evident injury of snapdragons nor was there any objectionable residue in the Farmingdale and Ithaca plots, where summer rains were fairly frequent. Additional observations on the Los Angeles plots, supplied by Dr. Baker, follow:

"1. Applications in this region must be made every 7 days. A 14-day interval gives essentially no commercial control, regardless of material. It is speculative whether this is due to (1) breakdown of spray residue between 7 and 14 days or (2) growth of new leaves which become infected before being covered by spray, but the second seems more probable.

"2. Parzate, 2 lbs./100 gals., applied every 7 days again gave perfectly satisfactory results. For seedsmen this still appears to be the best material, because of its slightly superior performance and the unimportance of the residue problem there. For cut flower growers the Dithane D-14, 2 qts. plus 1 lb. zinc sulfate/100 gals., applied every 7 days would be the better material because of commercially satisfactory performance and absence of conspicuous residue. Both gave an average of 0-1 performance on the scale indicated.

"3. All 14-day applications were approximately equal in ineffectiveness. While they all were decidedly better than the checks (which rated 3 on the scale) they certainly were not commercially satisfactory and also would be rated 3 on the scale. Because of the excessive time interval it is hard to evaluate them. Parzate and Dithane D-14 definitely are established as satisfactory with correct timing;

"3. Dithane Z-78 and IN10425 may well be effective on correct timing.

Manganese ethylene bis, both in 1946 and 1948, was unsatisfactory; it has nothing to offer in advantage over Parzate or Dithane D-14.

"4. There was no positive evidence of any phytotoxicity from the materials. Possibly Dithane Z-78 gave some stunting, but this is not certain."

SUMMARY OF DATA FROM NATIONAL COOPERATIVE POTATO SPRAY FUNGICIDE EXPERIMENT

W. F. Buchholtz

Contributors of data, by States:

Maine...........	Reiner Bonde
Connecticut.....	Saul Rich
New York........	Robert C. Cetas
Penneylvania....	Webster A. Chandler
New Jersey......	John C. Campbell
Delaware........	J. W. Heuberger
Tennessee.......	E. L. Felix
Ohio............	J. D. Wilson
Indiana.........	R. W. Samson
Michigan........	J. H. Muncie
Wisconsin.......	H. M. Darling
Iowa............	W. J. Hooker
Minnesota.......	Carl J. Eide
North Dakota....	Wm. G. Hoyman
Nebraska........	A. F. Sherf

PLAN OF THE EXPERIMENT

Spray Treatments

1.	Check, no fungicide...........	
2.	Bordeaux.......................	8-4-100
3.	Tribasic copper sulphate......	4-100
4.	Copper oxychloride sulphate...	4-100
5.	Copper zinc chromate..........	2-100
6.	Dithane D14 or Z78............	2-100
7.	Parzate.......................	2-100
8.	Zerlate.......................	1 1/2-100

DDT, 50%, 1 1/2 lb.-100, included in all fungicide sprays and applied alone to all no fungicide check plots.

SPRAY MATERIALS were acquired by the individual experimenters, in most instances directly from the manufacturer.

SPRAY EQUIPMENT was that available to individual experimenters. PRESSURES and DOSAGES were those effected by the equipment available.

PLOT SIZE varied; 50 ft. of row was suggested. Four to six REPLICATIONS were most commonly used.

Table 1. Location, diseases present, number and dates of sprays, variety, and planting and harvest dates for the 18 experiments in 15 States.

State, Location	Diseases Present: Late Blight	Diseases Present: Early Blight	Sprays: No.	Sprays: Dates	Variety	Planting Date	Harvest Date
1. Maine, Presque Isle	Moderate	Moderate	7	7/13-9/4	Katahdin	5/15	10/5
2. Connecticut Mt. Carmel	---	---	5	8/11-9/8	Katahdin	6/30	10/14
3. New York, Sagaponack, L. I.	Abundant	Abundant	11	6/8-8/18	Green Mountain	4/15	9/22
4. Pennsylvania, State College	Moderate	Moderate	10	6/28-9/2	Katahdin	6/1	10/14
5. State College	Moderate	Moderate	10	6/28-9/2	Russet Rural	6/1	10/14
6. New Jersey, Cranbury	Moderate	Present	6	6/12-7/9	Katahdin	4/15	9/13
7. Delaware, Selbyville	---	Heavy	5	8/6-9/17	Pontiac	6/23	10/14
8. Tennessee, Crossville	---	Moderate	8	6/1-7/10	Katahdin	4/30	7/30
9. Ohio, Wooster	---	Moderate	7	7/12-9/12	Katahdin	6/3	10/20
10. Wooster	Moderate	Heavy	6	6/11-7/28	Cobbler	4/12	8/27
11. Marietta	Moderate	Heavy	6	5/20-7/9	Cobbler	3/29	8/9
12. Indiana, Lafayette	---	Present	4	7/3-8/10	Four*	4/30	9/20

Table 1. Location, diseases present, number and dates of sprays, variety, and planting and harvest dates for the 18 experiments in 15 States. (Continued)

State, Location	Diseases Present		Sprays		Variety	Planting Date	Harvest Date
	Late Blight	Early Blight	No.	Dates			
13. Michigan, Lake City	---	Abundant	7	6/29-8/30	Katahdin	5/17	9/13
14. Wisconsin, Starks	---	Heavy	8	7/7-9/1	Chippewa	5/20	9/30
15. Iowa, Crystal Lake	Moderate	Moderate	7	6/25-8/24	Cobbler	5/17	9/8
16. Minnesota, Crookston	Moderate	Abundant	6	7/18-8/28	Bliss Triumph	5/25	9/14
17. North Dakota, Northwood	Trace	Trace	6	7/12-9/3	Cobbler	6/10	10/12
18. Nebraska, Scottsbluff	---	Trace	2	8/11,8/31	Bliss Triumph	6/21	10/7

*Bliss Triumph, Chippewa, Katahdin, Sebago.

Table 2. Yields in potato spray plots in 18 similar experiments in 15 States.

		Check	Bor-deaux	Tri-basic	COCS.	Cu Zn Chr.	Di-Thane	Par-zate	Zer-late	M.S.D.
1.	Maine	407	467	483	487	479	482	476	489	39
2.	Connecticut	297	348	262	333	254	404	369	320	61
3.	New York	339	395	421	388	425	372	396	457	N.S.
4.	Pennsylvania									
	State College	355	386	416	380	386	409	429	388	36
5.	State College	331	372	393	---	395	416	415	---	48
6.	New Jersey	356	389	367	375	358	396	385	366	22
7.	Delaware	188	212	217	---	---	272	244	235	45
8.	Tennessee	134	143	126	137	---	135	131	---	N.S.
9.	Ohio									
	Wooster	294	---	314	328	342	358*	367	349	22
10.	Wooster	408	534	528	490	586	602*	621	566	58
11.	Marietta	398	562	558	538	547	588*	608	570	46
12.	Indiana	168	165	172	159	176	174	171	177	N.S.
13.	Michigan	305	277	283	279	281	343	342	353	50
14.	Wisconsin	356	377	400	397	428	449	441	404	26
15.	Iowa	311	377	425	---	405	428	428	402	38
16.	Minnesota	178	130	186	180	178	208	203	197	N.S.
17.	North Dakota	276**	---	281	---	304	314	315**	296**	17
18.	Nebraska	528	476	516	---	546	510	477	473	48

* Z 78

**DDT on check and Parzate and Zerlate applied as dusts in North Dakota.

Table 3. Percentages of defoliation in potato spray plots in 18 similar experiments in 15 States.

		Check	Bor-deaux	Tri-basic	COCS.	Cu Zn Chr.	Di-thane	Par-zate	Zer late	Date
1.	Maine	67	33	38	44	42	37	53	47	9/15
2.	Connecticut	no disease								
3.	New York	93	26	46	40	37	30	23	76	8/27
4.	Pennsylvania									
	State College	100	25	22	28	26	18	19	38	9/14
5.	State College	100	11	28	--	15	15	17	--	9/14
6.	New Jersey	31	2	2	2	2	4	2	17	
7.	Delaware	83	30	38	--	--	30	33	43	9/10
8.	Tennessee	33	33	37	17	--	36	33	--	6/29
9.	Ohio									
	Wooster	75	--	40	47	25	25*	27	25	9/18
10.	Wooster	96	55	52	65	37	40*	36	37	8/13
11.	Marietta	80	39	39	48	46	45*	36	44	7/17
12.	Indiana	no differences noted								
13.	Michigan	83	67	65	83	42	50	60	58	9/12
14.	Wisconsin	95	82	78	74	64	53	59	85	8/23
15.	Iowa	81	49	49	--	43	43	43	56	8/12
16.	Minnesota	82	9	18	20	15	16	14	56	9/2
17.	North Dakota	very little early blight								
18.	Nebraska	only trace early blight								

* Z 78

Table 4. Rank of treatments, by yield:

		Check	Bordeaux	Tribasic	COCS.	Cu Zn chr.	Dithane	Parzate	Zerlate
	In 8 experiments with both early and late blight.								
3.	New York	8	5	3	6	2	7	4	1
4.	Pennsylvania								
	State College	8	5	2	7	5	3	1	4
5.	State College	6	5	4	-	3	1	2	-
6.	New Jersey	8	2	5	4	7	1	3	6
10.	Ohio								
	Wooster	8	5	6	7	3	2	1	4
11.	Marietta	8	4	5	7	6	2	1	3
15.	Iowa	7	6	3	-	4	1	1	5
16.	Minnescta	7	5	4	5	7	1	2	3
	Average	7.5	4.6	4.0 (4.8)*	6.0	4.6	2.3	1.9 (2.6)**	3.7
	In 5 experiments with early blight but little or no late blight.								
1.	Maine	8	7	3	2	5	4	6	1
7.	Delaware	6	5	4	-	-	1	2	3
9.	Ohio,								
	Wooster	7	-	6	5	4	2	1	3
13.	Michigan	4	8	5	7	6	2	3	1
14.	Wisconsin	8	7	5	6	3	1	2	4
	Average	6.6	6.7	4.6 (5.4)*	5.0	4.5	2.0	2.8 (2.4)**	2.4

Table 4. (Continued)

		Check	Bor-deaux	Tri-basic	COCS.	Cu Zn chr.	Di-thane	Par-zate	Zer-late
	In 5 experiments with little or no early blight and no late blight.								
2.	Connecticut	6	3	7	4	8	1	2	5
8.	Tennessee	4	1	6	2	-	3	5	-
12.	Indiana	6	7	4	8	2	3	5	1
17.	North Dakota	6	-	5	-	3	2	1	4
18.	Nebraska	2	6	3	-	1	4	5	7
	Average	4.8	4.2	5.0	4.7	3.5	2.6	3.6	4.2
	Average, all	6.5	5.1	4.4	5.4	4.3	2.3	2.6	3.4
	experiments	8	6	5	7	4	1	2	3

* Average of 3 coppers

** Average of 3 zinc organics

(All rankings below check underlined)

Table 5. Rank of treatments, by percentage of defoliation:

		Check	Bor-deaux	Tri-basic	COCS.	Cu Zn chr.	Di-thane	Par-zate	Zer late
		In 8 experiments with both early and late blight.							
3.	New York	8	2	6	5	4	3	1	7
4.	Pennsylvania								
	State College	8	4	3	6	5	1	2	7
5.	State College	6	1	5	-	2	2	4	-
6.	New Jersey	8	1	1	1	1	6	1	7
10.	Ohio								
	Wooster	8	6	5	7	2	4	1	2
11.	Marietta	8	2	2	7	6	5	1	4
15.	Iowa	7	4	4	-	1	1	1	6
16.	Minnesota	8	1	5	6	3	4	2	7
	Average	7.6	2.6	3.9 (3.8)*	5.3	3.0	3.1	1.6 (3.4)**	5.7
		In 5 experiments with early blight but little or no late blight.							
1.	Maine	8	2	2	5	4	1	7	6
7.	Delaware	6	1	4	-	-	1	3	5
9.	Ohio,								
	Wooster	7	-	5	6	1	1	4	1
13.	Michigan	7	6	5	7	1	2	4	3
14.	Wisconsin	8	6	5	4	3	1	2	7
	Average	7.2	3.7	4.2 (4.5)*	5.5	2.2	1.2	4.0 (3.2)**	4.4

Table 5. (Continued)

		Check	Bor-deaux	Tri-basic	COCS.	Cu Zn chr.	Di-thane	Par-zate	Zer-late
		In 5 experiments with little or no early blight and no late blight.							
2.	Connecticut	no disease							
8.	Tennessee	2	2	<u>6</u>	1	-	<u>5</u>	2	-
12.	Indiana	no differences noted							
17.	North Dakota	very little blight							
19.	Nebraska	only trace early blight							
	Average	none computed							
	Average, all	7.1	2.9	4.1	5.0	2.7	2.6	2.5	5.1
	experiments	8	4	5	6	3	2	1	7

*Average of 3 coppers
**Average of 3 zinc organics
(All rankings below check underlined)

VARIETY and CULTURAL PRACTICES were those locally adapted and used.

DEFOLIATION PERCENTAGES were estimated after the method of Horsfall and Barratt. YIELDS were determined at harvest time.

Selection of spray materials and planning of the experiment were undertaken after all prospective cooperators had been consulted by correspondence.

The 1948 experiments were developed and executed with the same objectives and prerogatives in mind that were considered significant in 1947:

1. The effort is primarily one of coordinated evaluation of promising new organic fungicides.

2. A cooperative test such as this cannot make development by locally adapted spray programs one of its immediate objectives.

3. To facilitate reasonable comparisons this cooperative test must be small, simple and concise so that all cooperators will execute it in entirety.

In essence, the 1948 experiment is a duplicate of the 1947 experiment, with eight treatments rather than six as in 1947.

RESULTS

Table 1 contains information descriptive of the 18 individual experiments in 15 States. Each experiment is listed by number according to location and State, approximately according to geographic distribution. In all succeeding tables, these numbers are in the left column and are a means of reference to the experiments listed in table 1. Experiments 3, 4, 5, 6, 10, 11, 15 and 16 are those in which both early blight and late blight were present. In experiments 1, 7, 9, 13, and 14 there was early blight but little or no late blight. In experiments 2, 8, 12, 17 and 18 there was little or no early blight and no late blight. Tables 4 and 5 are arranged according to this grouping of the experiments. Tables 2 and 3 contain yield and defoliation data, respectively; in consecutive arrangement as in table 1.

In table 2 are yields in bushels per acre, for all treatments in each experiment, with minimum significant differences (M.S.D.) at the 5 percent level for each experiment unless mean differences were not significant (N.S.). In table 3 are percentages of defoliation for all treatments in each experiment. The dates of defoliation estimates are listed in the column to the right.

In table 4 are the yield ranks of treatments by experiments, in three groups as indicated above: 1) those with both early and late blight, 2) those with early blight only and 3) those with virtually none of either disease. Treatment rankings below that of the check are underlined. Included are average rankings of treatments by groups and for all experiments. The last row of treatment rankings is a composite based on average rankings for all experiments. In the groups of experiments with one or both diseases present, rankings of the three copper fungicides, Bordeaux, Tribasic and C-O-C-S, and of the 3 zinc-containing organics, Dithane, Parzate and Zerlate, have been pooled into averages (in parentheses and with asterisks) which are in the Tribasic and Parzate columns, respectively.

In table 5, ranks of treatments, by percentage of defoliation, are presented in an arrangement identical to that in table 4. For only one experiment in the group with little or no disease (8, Tennessee) were any defoliation estimates made.

When comparing the relative performance of the fungicide treatments in these experiments, it is appropriate to have in mind that in none of them was late blight development intensive for a sustained period during the growing season. Furthermore, in only two States (New York with 11, Pennsylvania with 10) were more than 8 sprays applied during the season. In 10 of the 18 experiments, of course, there was little or no late blight.

Under these conditions Dithane and Parzate were the over-all high-ranking treatments both by yield and by percentage of defoliation. By yield, the 3 zinc organics, Dithane (1), Parzate (2) and Zerlate (3) outranked the 3 coppers, Bordeaux (6), Tribasic (5) and C-O-C-S (7). Copper zinc chromate ranked fourth, alongside Tribasic.

Certain inter-group comparisons of average ranks seem pertinent. For instance, the 3 coppers tended to be ranked better by percentage of defoliation (3.8, 4.5) than by yield (4.8, 5.4); conversely, the 3 zinc organics tended to be ranked poorer by percentage of defoliation (3.4, 3.2) than by yield (2.6, 2.4). Copper zinc chromate seems, like the coppers, to be ranked higher by percentage of defoliation than by yield. These comparisons are between groups of experiments with one or both diseases present in which defoliation estimates were available.

Both by yield and by percentage of defoliation, the coppers tend to rank higher in experiments with both early and late blight (4.8, 3.8) than in experiments with early blight only (5.4, 4.5). A possible exception is C-O-C-S.

Similar comparisons of individual treatments seem non-fruitful, with the possible exception of those involving Bordeaux and Zerlate. Bordeaux ranked better by percentage of defoliation (2.6, 3.7) than by yield (4.6, 6.7); Zerlate ranked poorer by percentage of defoliation (5.7, 4.4) than by yield (3.7, 2.4). In experiments with late blight as well as early blight, Bordeaux ranked higher both by yield and by percentage of defoliation (4.6, 2.6) than in experiments with early blight only--no late blight (6.7, 3.7).

These comparisons between Bordeaux and Zerlate seem to fairly well summarize the evidence for 1948 for all materials. The zinc organics were in general superior to the coppers, more so in yield than in disease control, especially where early blight was the only disease in evidence. Where late blight was present the coppers, especially Bordeaux and Tribasic, performed credibly, especially in disease control (percentage of defoliation). In general these results confirm those recorded in 1947. They seem furthermore to be in accord with the oft-repeated suggestions that the coppers tend to be superior to the zinc organics for late blight control, not so for early blight control (perhaps the reverse); that the coppers, particularly Bordeaux, are toxic to potato foliage, and that the zinc organics are not so toxic, and may in certain instances be stimulatory.

SUMMARY OF 1948 COOPERATIVE TOMATO FUNGICIDE EXPERIMENTS

M. B. Linn[1]

The following States and cooperators (plot location in parentheses) submitted data for this report:

Delaware (Wyoming)--J. W. Heuberger
Illinois (Urbana)--M. B. Linn and R. G. Emge
Iowa (Ames, Test 1, and Conesville, Test 2) W. J. Hooker and N. R. Gerhold
Maine (Orono)--M. T. Hilborn

Maryland (Hurlock)--C. E. Cox
Michigan (E. Lansing)--M. C. Strong
Minnesota (University Farm)-- C. J. Eide
New Jersey (N. Brunswick, Test 1)-- B. H. Davis
New Jersey (Riverton, Test 2)-- S. G. Younkin
New York (Geneva)-- W. T. Schroeder
North Carolina (Hendersonville)-- D. E. Ellis
North Dakota (Fargo)-- W. E. Brentzel
Ohio (Wooster, Test 1; Fremont, Test 2; and Apple Creek, Test 3)-- J.D. Wilson
Pennsylvania (State College, Test 1, and Lebanon Co., Test 2)-- W. S. Beach
South Carolina (Charleston)-- W. M. Epps
South Dakota (Brookings)--C. M. Nagel
Tennessee (Knoxville, Test 1)-- E. L. Felix
Tennessee (Jackson, Test 2)-- J. M. Epps

Spray plots of R. W. Samson (Indiana) were lost to cucumber mosaic early in the season.

Most of the six fungicides or treatments chosen by the cooperators were used in all but a few tests. These materials are numbered 1 to 6 below. In some instances cooperators tried combinations or alternating applications of fungicides. Relatively new materials were subjected to critical field tests in several States. These materials and combinations at concentrations generally used, with abbreviations in parentheses adopted for tabulation, are:

Sprays

1. Bordeaux mixture 8-8-100
2. Dithane Z-78 (Z-78) 2-100
3. Parzate 2-100
4. Tribasic copper sulfate (Tribasic) 4-100
5. Zerlate 2 lb.-100 gal.
6. Zerlate alternating with Tribasic (Z-T-Z-T-Z) 2 and 4-100
7. CuZnChromate L. 658 (CuZnCh) 2 to 4-100
8. Yellow Cuprocide (Cu_2O) 1.5-100
9. Copper oxychloride sulfate (C-O-C-S) 4-100
10. Copper A 4-100
11. Bioquin 1 (Bioq.1) 1-100
12. Bioquin 50W (Bioq.50W) 1-100
13. Bioquin 1 + wettable sulfur (Bioq. + S.) 1/4-3-100
14. Tennessee Copper + Zinc (Tenn. Cu+Zn) 5 to 5.5-100

[1] Sincere thanks are extended to each cooperator and fungicide manufacturer who made these tests possible.

15. Gen. Chem. 308 (G. C. 308) 3-100
16. Gen. Chem. 629 (G. C. 629) 3-100
17. Phygon XL 1-100
18. Manganese ethylene bis-dithiocarbamate (Mn ethyl.) 2-100
19. Zerlate alternating with Bordeaux (Z-Z-B-Z-B and Z-B-Z-B-Z)
20. Zerlate alternating with Tribasic (Z-Z-Z-T-T and Z-Z-T-Z-T)
21. Zerlate alternating with D-14 (Z-Z-14-Z-14)
22. Zerlate alternating with Z-78 (Z-Z-78-Z-78)
23. Zerlate + Tribasic-tank mix (Z+T) Ill. =1-2-100; Pa.= 2-2.7-100
24. Zerlate + Parzate-tank mix (Z+P) Ill. and Pa. =1-1-100; N.Y.=1.5-1.5-100
25. Dithane D-14 + zinc sulfate (D-14) 2 qt.-1 lb.-100
26. IN-10425 + zinc sulfate (IN-10425) Ill. and Md. = 2 qt. -3/4 lb-100; Pa.=2 qt.-1 lb. -100
27. Goodrite Zac (Zac) 2-100
28. Methasan, wettable (Meth.) 3 lb.-100

Dusts

1. Copper oxychloride sulfate 15%
2. CuZnChromate 15%
3. Dithane Z-78-13%
4. Parzate 10-13%
5. Tribasic copper sulfate 6-7% Cu as metallic
6. Yellow Cuprocide 5%
7. Zerlate 10-13%
8. Zerlate alternating with Tribasic

It was suggested that each cooperator use as a minimum five replicates of 10 plants each and that five applications of fungicides be put on at 10-day intervals. The time of first application was left strictly to the discretion of the individual cooperator, although it was hoped that this would be not later than 30 days after the appearance of the first crown flowers. It was also suggested that any fruit with one or more anthracnose lesions be classified as a cull. The method of Horsfall and Barratt was to be used in estimating defoliation.

Rohm and Haas sticker and spreader Triton B-1956 was supplied to each cooperator to use if he saw fit.

Observations covering performance of fungicides, incidence of diseases, weather conditions, phytotoxicity, etc., were submitted by most cooperators during or at the end of the season. These have been condensed as much as possible in this summary. These notes should be extremely useful in evaluating the results of tests in individual States and are therefore worthy of careful reading.

The data from the spray experiments are summarized by States and treatments in Tables 1-5, and those from dust experiments in Table 6.

Table 1. Yields in Tons per Acre (Nos. 1 and 2) Spray Experiments on Tomatoes, 1948
(Six "first choice" treatments used in each test)

Treatment	Del.	Ill. (1)	Md.	Mich.	Ohio (3)	Pa. (1)	Minn.	N. J. (1)	Mean
Z-78	9.50	20.54	6.3	17.5	14.38	25.3	13.15	17.8	15.6
Parzate	9.47	19.47	3.8	15.5	15.80	22.5	15.15	18.4	15.0
Z-T-Z-T-Z	8.68	13.75	5.6	15.1	15.08	24.0	12.90	17.9	14.7
Tribasic	8.34	13.53	7.9	16.2	15.13	23.8	13.90	17.7	14.6
Bordeaux	8.93	16.05	6.1	16.2	13.00	24.0	11.01	16.5	14.0
Zerlate	9.56	17.49	4.9	13.5	14.50	18.6	13.74	17.5	13.7
None	4.93	7.43	2.8	13.6	11.53	11.5	14.14	18.5	10.5
CuZnCh				14.9	12.95	20.8			
Cu_2O				15.8					
Bioq. 1				16.8					
Bioq. 50W			5.1						
Tenn. Cu+Zn						23.1			
Phygon XL			3.9	17.5					
Z-Z-B-Z-B						22.6			
Z-B-Z-B-Z					13.43				
Z-Z-Z-T-T			4.7			23.1			
Z + T						23.7			
Z + P						19.9			
D-14		21.66	5.9	17.6					
IN-10425			3.9			20.7			
Zac				16.3		22.3			
Meth.					15.83				
L.S.D. (5%)	1.66	4.72	0.9	1.8	1.9	5.1	1.48	N.Sig.	

Late blight damaging in Pennsylvania (1); Septoria leaf spot predominant in Maryland, early blight prevalent in all tests except Minnesota and New Jersey (1) where but little of any disease was present.

Table 2. Yields in Tons per Acre (Nos. 1 and 2), Spray Experiments on Tomatoes, 1948
(Six "first-choice" treatments not used in each test)

Treatment	N.J. (2)	Ohio (2)	S.D.	Tenn. (1)	Iowa (1)	Iowa (2)	Me.	N.D.	Chio (1)	Pa. (2)	Tenn. (2)	N.C.	N.Y.	Ill. (2)
Z-78		18.8	7.60				15.8	26.90	15.16	12.7	3.58			
Parzate	10.19	20.4		8.13	13.0	12.8	17.0		15.58	13.1	5.32	8.64		
Z-T-Z-T-Z	9.92	18.9	7.46					26.02						
Tribasic	10.08	18.6	6.39	8.24	15.5	14.1	14.9	24.56	14.65	14.2	4.64	11.65		
Bordeaux	7.98		7.23	6.56	15.0	14.4					4.87			
Zerlate	10.68	21.1	6.90	8.18	15.8	14.1	15.6	24.93	14.91	14.8	4.34		20.9	
None	6.84	16.0	5.02	8.09	17.9	13.2	13.4	24.66	14.58	8.7	4.37	3.24	20.5	7.8
CuZnCh	10.31	17.9	6.37	10.10			14.3		14.55		4.84		19.5[a]	
Cu_2O			7.03					25.60			4.40			
C-O-C-S	10.02			7.99					14.15					
Copper A				8.01										
Bioq. 1	12.04						17.0							13.5
Bioq. 50W														10.4
Bioq. + S.														19.3
Tenn. Cu+Zn	9.06									15.1				5.9
G. C. 308							14.4							
G. C. 629							13.3							
Phygon XL			6.94					25.53					21.3[a]	
Mn ethyl														21.3
Z-Z-B-Z-B										13.4			22.5	
Z-Z-T-Z-T	10.27												21.6	
Z-Z-Z-T-T	10.19									13.9				
Z-Z-14-Z-14													20.8	
Z-Z-78-Z-78													21.6	
Z + T										14.0				17.2
Z + P										12.7			23.6	20.1
D-14				8.73										

Table 2. (Continued)

Treatment	N.J. (2)	Ohio (2)	S.D.	Tenn. (1)	Iowa (1)	Iowa (2)	Me.	N.D.	Ohio (1)	Pa. (2)	Tenn. (2)	N.C.	N.Y.	Ill. (2)
IN-10425														17.2
Zac	9.54						17.2							14.3
Meth.									16.24					
L.S.D. (5%)	1.81	--	1.33	2.23	N.S.	N.S.	2.1	N.S.	1.7	3.2	N.S.	3.62	N.S.	N.S.

[a]Orthol K added to all but these treatments.

Late blight damaging in Ohio (2), Pennsylvania (2), South Dakota and North Carolina; early blight prevalent in all tests except South Dakota, Maine, North Dakota, Tennessee (2) and North Carolina.

Table 3. Per cent Defoliation, Spray Experiments on Tomatoes, 1948

Treatment	Del.	Ill.[a] (1)	Md.	Mich.	Ohio (3)	Pa. (1)	Minn.	Mean	Iowa (1)	Iowa (2)	N.D.	Ohio (1)	N.C.	Tenn. (1)	N.Y.	Ill. (2)
Z-78	18	2	46	40	36	6	18	23.7			5	22		60		
Bordeaux	25	7	46	35	32	6	15	23.7	32	23						
Tribasic	33	12	39	36	28	6	18	24.6	32	23	2	30	20			
Parzate	23	3	74	41	32	6	17	28.0	37	74		25	30			
Z-T-Z-T-Z	33	6	65	40	38	11	19	30.3			3					
Zerlate	40	7	62	45	50	22	17	34.7	37	39	2	27		60	7	
None	70	67	85	51	76	45	21	59.3	43	84	8	65	58	60	78	95
CuZnCh				37	34	9			37	43		27		50	20[b]	
Cu2O				35							5			60		
C-O-C-S												32		60		
Copper A														70		
Bioq. 1		5		40												30
Bioq. 50W			60													60
Bioq. + S.																10
Tenn. Cu+Zn						9										55
Phygon XL			65	35							7				30[b]	
Mn ethyl.																5
Z-Z-B-Z-B						6									4	
Z-B-Z-B-Z					36											
Z-Z-T-Z-T															5	
Z-Z-Z-T-T						11										
Z-Z-14-Z-14															5	
Z-Z-78-Z-78															5	
Z + T						6										20
Z + P						10									3	15

Table 3. (Continued)

Treatment	Del.	Ill.[a] (1)	Md.	Mich.	Ohio (3)	Pa. (1)	Minn.	Mean	Iowa (1)	Iowa (2)	N.D.	Ohio (1)	N.C.	Tenn. (1)	N.Y.	Ill. (2)
D-14		2	50	40												
IN-10425			58			10										50
Zac				43		20										50
Meth.					36							22				
L.S.D. (5%)		3		5		3									6	

[a]Severe red spider mite infestation prevented accurate defoliation records after September 10.
[b]Orthol K added to all but these treatments.

Late blight damaging in Pennsylvania (1) and North Carolina, Septoria leaf spot predominant in Maryland, early blight prevalent in all others except Minnesota and North Dakota where but little of any disease was present.

Table 4. Per cent Anthracnose, Spray Experiments on Tomatoes, 1948

Treatment	Del.	Ill. (1)	Ohio (3)	Pa. (1)	N.J. (1)	Mean	N.J. (2)	Ohio (2)	Ohio (1)	Pa. (2)	N.Y.	Ill. (2)
Parzate	6.9	11.70	4.5	5.2	2.5	6.2	11.20	11.9	0.3	7.1		
Z-78	6.3	14.80	5.0	3.1	2.5	6.3		14.4	0.1	3.3		
Zerlate	6.4	17.55	3.4	3.6	1.8	6.5	4.95	10.0	0.1	2.4	6.8	
Z-T-Z-T-Z	9.3	15.93	3.7	4.1	1.7	6.9	7.10	12.4				
Bordeaux	9.6	33.71	6.2	8.5	1.4	11.8	11.52					
Tribasic	12.3	37.51	5.6	12.4	2.3	14.0	10.15	22.3	0.5	10.0		
None	27.3	63.04	14.1	28.5	3.0	27.2	31.97	29.3	1.6	12.7	12.8	47.5
CuZnCh			6.9	14.1			12.22	18.9	0.4		14.1[a]	
C-O-C-S							11.35		0.3			
Bioq. 1		24.67					12.20					35.5
Bioq. 50W												48.8
Bioq. + S.												13.0
Tenn.Cu+Zn				13.1			10.15			12.6		50.2
Phygon XL											6.7[a]	
Mn ethyl.												2.2
Z-Z-B-Z-B				3.1						5.2	3.6	
Z-B-Z-B-Z			3.5									
Z-Z-T-Z-T							5.67				5.1	
Z-Z-Z-T-T				8.2			4.42			4.1		
Z-Z-14-Z-14											6.1	
Z-Z-78-Z-78											5.5	
Z + T				4.4						3.7		19.7
Z + P				3.4						2.4	3.9	10.8

Table 4. (Continued)

Treatment	Del.	Ill. (1)	Ohio (3)	Pa. (1)	N.J. (1)	Mean	N.J. (2)	Ohio (2)	Ohio (1)	Pa. (2)	N.Y.	Ill. (2)
D-14		5.15		9.6								
IN-10425												17.8
Zac				4.6			10.12					33.7
Meth.			1.7						0.1			
L.S.D. (5%)	3.8	4.72	2.8	6.4	N.S.		5.09	2.4	-	2.3	2.2	14.2

[a]Orthol K added to all but these treatments.

Table 5. Per cent of Late Blight Fruit Rot, Spray Experiments on Tomatoes. 1948

Treatment	Pa. (1)	Pa. (2)	Ohio (2)	N.C.
Zerlate	12.3	9.0	2.3	
Tribasic	2.2	6.0	0	11.3
Parzate	11.0	10.2	0.2	21.8
Z-78	8.8	10.7	0.1	
Bordeaux	5.9			
Z-T-Z-T-Z	11.2		0.6	
None	15.0	11.1	4.5	65.4
CuZnCh	7.4		0.1	
Tenn. (Cu+Zn)	6.6	7.4		
Z-Z-B-Z-B	5.0	7.1		
Z-Z-Z-T-T	5.0	10.6		
Z + T	5.5	9.4		
Z + P	10.5	7.1		
Zac	10.5			
L.S.D.	--	--	--	8.5

Table 6. Yields in Tons per Acre (Nos. 1 and 2) and Per cent Fruit Rot and Defoliation, Dust Experiments on Tomatoes. 1948

Treatment[a]	Yield/Tons per acre			Per cent fruit rot			Per cent defoliation[bc]		
	Tenn. (2)	Tenn. (1)	S.C.	N.C.	Tenn. (1)	S.C.	N.C.	Tenn. (1)	N.C.
Zerlate	6.83	6.56	4.28	..	41.2	9.41		60	
Tribasic	7.90		5.98	11.61		0.60	9.1		22
Parzate	6.40		5.54	8.23		4.69	24.1		25
Z-78	7.80	6.78			50.4			60	
Z-T-Z-T-Z			5.25	7.42		2.85	40.6		30
None	6.90	6.51	2.36	3.24	32.0	29.44	65.4	60	58
CuZnCh	5.79	8.18			27.5			50	
Cu_2O	6.73	7.53			27.4			60	
C-O-C-S		7.69			19.7			60	
Copper A	6.51								
L.S.D.	--	2.3	1.72	3.62	--	--	8.5	--	8.7

[a]See spray treatments for Tennessee (1) (2) and North Carolina.

[b]Defoliation for S. C. plots worst in Zerlate; least in Tribasic; intermediate and about equal in Parzate and Z-T.

[c]Cladosporium leaf-mold infection index (North Carolina); Parzate=45, Tribasic=26; Z-T=32; None=65; L.S.D.=12.4.

Severe late blight infection in North Carolina and South Carolina.

No attempt has been made to develop efficiency ratings, such as was done for the 1947 report. Comparisons within tests are particularly valuable where the L. S. D. is given. The mean has been calculated for the data from experiments involving all six first choice treatments.

Practically all of the optional treatments are listed, even where they were tried by only one or two cooperators, because of their possible importance in future research on tomato fungicides.

Summary of Notes From Cooperators

Delaware (J. W. Heuberger). Most of the defoliation was caused by early blight, although *Septoria* was present until middle of August. Zerlate was somewhat poorer than in past years, possibly because of failure to control *Septoria* earlier. There was no evidence of phytotoxicity from any materials.

Illinois (M. B. Linn). Early blight was responsible for defoliation. Anthracnose was extremely severe, appearing at first harvest on August 4. Dithane D-14 was best, with Zerlate somewhat poorer than in 1947. Slight yellowing of leaflet margins was noted in Parzate and D-14 plots, but not in Z-78. Triton was used with all sprays. Red spider injury prevented defoliation records in Test 1 after September 10.

Iowa (W. J. Hooker). Defoliation was caused by *Alternaria*. Triton was used with all sprays except Bordeaux.

Maine (M. T. Hilborn). All plots were inoculated twice with *Phytophthora infestans*, with neither inoculation effective because of hot, dry weather. Only a slight amount of early blight was present, although a combination of this disease and flea beetles reduced yield from control plots. Only treatment showing spray injury was Gen. Chem. 629, severe leaf roll developing 26 days before first harvest.

Maryland (C. E. Cox). Defoliation was due mostly to *Septoria* and *Alternaria*, the former being the more damaging. Late blight was present by midseason, but was never a serious factor. Anthracnose occurred only in trace amounts. Zerlate and Triton were not appreciably better than Zerlate alone.

Michigan (M. C. Strong). Slight early blight infection was evident at third spray application, increasing gradually until end of season. No spray materials caused injury. Because of the dry season, there was less defoliation than in 1947. Percentage of culls was higher than in 1947, partly because of soft rots following pheasant damage.

Minnesota (C. J. Eide). Practically no diseases were present in plots, with defoliation seemingly due to nonpathogenic causes. A very few anthracnose-infected fruits were found during September. Some sprays tended to delay ripening, although Bordeaux was the only one resulting in significantly less ripe fruit than control. Parzate plots produced the most ripe fruit and the highest total yield.

New Jersey (B. H. Davis, Test 1). Very little disease was present, and consequently little difference was noted between yields, culls, anthracnose and defoliation as a result of the various treatments.

New Jersey (S. G. Younkin, Test 2). A five-application schedule was not enough to prevent defoliation this year. By the time of fourth harvest, all plots were defoliated.

New York (W. T. Schroeder). Early blight was the only foliage disease, a light infection occurring quite late in the season. Differences in yield data were not significant, chiefly because viroses made it difficult to eliminate plants so affected or otherwise to provide for more uniformity within the plots. Several comparisons were made of fungicides with and without adjuvants.

North Carolina (D. E. Ellis). Plants were infected with Cladosporium when set in field. Late blight was first observed on July 15 or on the day the first fungicide was applied.

North Dakota (W. E. Brentzel). Very little disease developed in the plots. Some early blight was noted early in season, but it was confined almost entirely to lower leaves.

Ohio (J. D. Wilson). Late blight developed only in the plots at Fremont (Test 2). There was very little Septoria, but Alternaria caused considerable fruit infection at both stem and blossom ends. Some yellowing of leaflets was noted in Parzate, D-14 and Z-78 plots. Zerlate gave best control of anthracnose, but did not do so well in controlling defoliation.

Pennsylvania (W. S. Beach). First traces of late blight were noted at State College (Test 1) on August 20, eight days after the last spray. Progress of late blight was less rapid than in 1946-47. Late blight infections were not numerous on fruit. The situation in Lebanon County (Test 2) was quite similar. Tank mixture of Zerlate and Tribasic may make it possible tp simplify recommendations. Zerlate used alone was rather poor for early and late blights. Z-78 was one of the best treatments for control of early blight and anthracnose. Fruit in Test 2 plots was damaged by hail late in July, resulting in an unusal amount of soft rot.

South Carolina (W. M. Epps). Early blight, leaf mold and gray leaf spot (Stemphylium) were present only in trace amounts. Late blight appeared as a trace in the middle of May. All plots were severely damaged, and many half-developed fruits rotted. Data for fruit rot do not present a true picture, because many small green fruits were lost before reaching marketable size. Late-blight fruit damage was noted only at first harvest.

South Dakota (C. M. Nagel). Septoria leaf spot did not develop at all although conditions were thought to be ideal. Bacterial spot and speck did considerable damage to fruit throughout all plots. Late blight was severe especially on fruits toward the end of the season but was localized in the experimental area.

Tennessee (E. L. Felix, Test 1). Early blight first appeared on July 6 and became severe during the week end of July 31--August 2. Losses from Rhizoctonia and buckeye fruit rots and from sunscald were worse in dusted than in sprayed plots because the former were on low, poorly drained soil. The first two applications of Bordeaux injured foliage, probably because of chemical impurities. The apparently greater value of C-O-C-S dust over C-O-C-S spray in fruit rot control is believed to have resulted from applying three times more copper per acre in dust form. Any form of copper applied in equivalent amounts (90 pounds per acre) would possibly have been as effective. Resyn adhesive No. 3605 (National Starch Products) at 1/2 pint to 100 gallons was outstanding as sticker for copper sprays, particularly Bordeaux and Tribasic. Armour sticker (1 1/2 pounds to 100 gallons) appeared best for organics. Du Pont spreader-sticker and Triton B-1956 proved inadequate as stickers. Armour sticker (10-12%) is suggested for dust adherence.

Tennessee (J. M. Epps, Test 2). The only disease that appeared to cause any serious damage was early blight, but this did not develop to any appreciable extent until after the end of the harvest period. There was no apparent injury from any fungicides. Weather was not favorable for late blight development.

GENERAL SUMMARY

First Six Materials

Sprays. From the means in Tables 1 and 3, it appears that Dithane Z-78 was somewhat superior to the other dithiocarbamates with regard to yields. However, in eight of the total 13 tests (Tables 1 and 2) in which both Parzate and Z-78 appeared, Parzate plots yielded more than Z-78 plots. Regardless of possible differences between these two similar materials, each of them was somewhat better than other treatments from the standpoint of yield. In the control of defoliation (Table 3) due principally to early blight, there was but little difference among Z-78, Tribasic and Bordeaux. Zerlate was appreciably inferior.

The means of the first five tests in Table 4 suggest that Zerlate, Z-78 and Parzate were about equally effective in controlling anthracnose. However, the data from all of the nine pertinent tests indicate that Zerlate was probably the best of these three fungicides. As would be expected from previous tests, Tribasic and Bordeaux were rather poor in this respect. Tribasic was best for the control of *Septoria* leaf spot (Maryland, Tables 1 and 3) and late blight (Table 5).

Dusts. Among dust treatments, (Table 6) Tribasic seemed to be superior to all other fungicides and combinations, particularly in States where late blight and *Cladosporium* leaf mold were factors in reducing yields. The organic zinc dusts used in these tests do not seem adequate for the control of these two diseases.

Optional Treatments

There are a number of the new fungicides, used alone or in combination with others, that appear promising for the control of early blight and anthracnose of tomatoes. Among the better ones are Zerlate plus Tribasic, Zerlate plus Parzate, Bioquin 1 plus wettable sulfur, manganese ethylene bisdithiocarbamate, Zerlate alternating with D-14 or Z-78, Zerlate alternating with Bordeaux, and wettable Methasan. There are many combinations of other zinc organics and fixed coppers, trials of which may be suggested by these data.

THE PLANT DISEASE REPORTER

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Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

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SUPPLEMENT 184.

NEW OR UNUSUAL RECORDS AND OUTSTANDING FEATURES OF PLANT DISEASE DEVELOPMENT IN THE UNITED STATES IN 1948

Supplement 184 April 30, 1949

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

NEW OR UNUSUAL RECORDS AND OUTSTANDING FEATURES OF PLANT DISEASE DEVELOPMENT IN THE UNITED STATES IN 1948

Compiled by Nellie W. Nance

Plant Disease Reporter
Supplement 184 April 30, 1949

Reports to the Plant Disease Survey, from which this information is taken for the most part, indicate that plant diseases in 1948 were generally less prevalent than in an average year. There were no widespread epidemics and losses generally were considerably less than in 1947. 1948 was marked by several unusual features in cereal pathology. Victoria blight of oats seemed relatively unimportant as compared to 1947. Susceptible varieties planted from untreated seeds showed the most infection. Crown rust of oats was less prevalent in some States than in any year previously recorded. This was a year of the lightest leaf rust of wheat for 10 years or more. Tobacco blue mold was generally lighter in 1948 than in 1947. In Georgia tobacco plants were more plentiful than in any year since 1940. Estimated losses from downy mildew of cucurbits were low. Owing to the hot dry weather and adequate control measures late blight of tomato did not reach the epidemic proportions of the 1946 late blight attack. In spite of some severe losses a good crop was grown.

During the year 28 diseases were reported on 26 crops in 34 States in which they had not previously been known to occur, these are presented in Table 1. "New" diseases, i.e. not previously reported to the Plant Disease Survey before 1948, discovered in this country for the first time, or found on a new host are presented in Table 2.

A review of the monthly weather conditions in relation to late blight incidence for the months April through September for the years 1946, 1947 and 1948 is given in the April 1949 issue of the Reporter. The 1948 season was characterized by a somewhat irregular weather picture with a wet spring, mostly in the eastern areas, and a wet early summer followed by a dry August and September.

In the Northwest, the weather after February became less open with frequent snows and cold rains. The total precipitation from September 1 to April 20 was more than 23 inches and the soils were heavy with excess water. The heavy losses experienced from some diseases were accredited to the unusual amount of rain during the growing season.

Table 1. Diseases reported in States where they had not been found on a particular host until 1948.*

Host Disease (Cause)	Where found	Remarks
OATS		
Downy Mildew, (Sclerospora macrospora)	Idaho Indiana (1947)	Infected plants were stunted and their panicles were variously abnormal. Oospores found on leaf blades, sheaths, and glumes. (PDR 33(2):79)
WHEAT		
Leaf Spot, (Helminthosporium tritici-vulgaris)	Georgia	Sanford wheat heavily infected with small circular leaf spots. Plants outgrew the disease in one month. (PDR 32(6):275)
ALFALFA		
Stem nematode, (Ditylenchus dipsaci)	Georgia Virginia	(PDR 32(8):350 (PDR 32(10):444
Fusarium wilt	Georgia	Found in the same field with the stem nematode (PDR 32(8):350-351)
COWPEA		
Cladosporium spot (C. vignae)	California	The disease was apparently introduced by contaminated seed stock. Also found in 1947, but this is first report (PDR 32(1):478)
LUPINE, WHITE		
Brown spot (Ceratophorum setosum)	Louisiana	Found in nursery, estimated 50% of planting was affected (PDR 32(7): 318)

*For new State-host records of grasses see PDR 32(6):246.

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
APRICOT Verticillium wilt (V. alboatrum)	Washington	The organism was isolated from the mummies, dead twigs, and the wood of the main limb of specimen. (PDR 33(2):99)
CHERRY Blossom and twig blight (Monilinia laxa)	Michigan	Affected trees were in orchards near the shore of Lake Michigan. (PDR 33(2):96)
PEACH Rust (Tranzschelia pruni-spinosae) parasitized by Darluca filum	Texas	Unusual in that rust was observed on peach very early in season during the first week of April. (PDR 32(7):308
PECAN Scab (Cladosporium effusum)	Maryland	(PDR 32(9):395)
COTTON Verticillium wilt (V. alboatrum)	Georgia	Affected plants showed only slight stunting and little if any reduction in yield. (PDR 33(2):78-79)
PEANUT Root knot (Heterodera marioni)	Alabama	Infection found in only one field, although every plant was infected the disease was most severe in a few localized spots. (PDR 32(10):443)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
PEANUT Rust (*Puccinia arachidis*)	Louisiana	Affected plants were badly "rusty" and defoliated. (PDR 32(11):482)
SAFFLOWER Root rot (cause undetermined)	Nebraska	Introductions from India and Africa are 50 to 100% susceptible. Those from other countries have a high resistance. (PDR 33 (2):73-75)
TOBACCO Etch (virus)	North Carolina	Found on variety Oxford 26. More than 50% of the plants of a 300 plant plot were affected. (PDR 33(2):77)
BEAN Leaf spot (*Ascochyta phaseolorum*)	Washington	This fungus is rarely reported.
BEAN Corral spot	California	Noted in a 110-acre field of Red Kidney beans in San Joaquin County. Symptoms agree with the description of zinc deficiency of beans in Florida. First report on any annual in Calif. (PDR 33(2):93-94)
BEAN, LIMA Anthracnose (*Colletotrichum truncatum*)	Maryland	Leaf infection caused much defoliation; considerable loss from pod infection. (PDR 32(10):450)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
CABBAGE Yellows (*Fusarium oxysporum* f. *conglutinans*)	New Mexico	It is believed that the causal organism has been present in southern New Mexico for several years. (PDR 32(8):346)
CANTALOUPE *Fusarium* wilt [*F. oxysprrum* f. *melonis*]	New Jersey	(PDR 32(9):395)
ONION Smudge (*Colletotrichum circinans*)	Washington	Widely distributed in the U. S. east of Rocky Mountains. Climatic factors limit the appearance of the disease in the Pacific Coast States. (PDR 32(12):518)
POTATO Corky ringspot (cause unknown)	Indiana	Found in a lot of 300 bags of round white potatoes grown in Indiana and shipped to Georgia in November 1948. Inspection certificates showed 30% of the potatoes affected with internal browning or discoloration. This disease was first observed in the U.S. (Fla.) in 1946. (PDR 33(2):95)
AZALEA Flower blight (*Ovulinia azaleae*)	Georgia	Both red and white forms were heavily infected in March. (PDR 32(6):275)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
CAMELLIA		
Flower blight (*Sclerotinia camelliae*)	Georgia	Found in a private garden in three widely separated greenhouses as well as on plants growing in the open. (PDR 32(7):317)
GLADIOLUS		
Curvularia spot (possibly *C. lunata*)	Mississippi	Reported in a field of 150,000 plants, both from local and Oregon grown corms. (PDR 32(1):11-13)
	New York	Found in the variety Vredenburg. Stock had come from State of Wash. originally.
	North Carolina	Both leaves and flowers were infected.
	Maryland	Found on the variety Picardy at Beltsville.
	Michigan	Found on the variety Myrna.
	Virginia	Reported in October near Norfolk. (PDR 33(2):66-68)
WEIGELA		
Meadow nematode (*Pratylenchus pratensis*)	Kentucky	Reported from a nursery in Mt. Sterling. (PDR 32(4):133-134)
DOGWOOD, FLOWERING		
Spot anthracnose (*Elsinoë* sp.)	Georgia and Virginia	Reported in Maryland, North Carolina and South Carolina in previous years. (PDR 32(6):253-255)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
ELM Dutch elm disease (Ceratostomella ulmi)	Colorado	Evidence of the disease and its carrier Scolytus multistriatus was observed in January. Origin of this disease in Colorado is not known. (PDR 32(7):317)

Table 2. Diseases found in this country for the first time in 1948 = *; diseases found on new hosts = ** .

Host Disease (Cause)	Where found	Remarks
WHEAT Leaf spot (Selenophoma donacis var. stomaticola) *	Idaho and Washington	Causes a small circular ashy spot with a narrow surrounding border. (PDR 32(9):392-394)
SOIL SAMPLES (Heterodera punctata)*	North Dakota	British workers think that Agrostis is the normal host of this species. Originally described by Thorne as the cause of poor growth of wheat in Saskatchewan. (PDR 33(3):130-131)
AVOCADO (Persea americana, P. a. var. drymifolia) Verticillium wilt (V. alboatrum)**	Five counties in southern Calif.	Apparently the first report of this fungus on a member of the Lauraceae. (PDR 33(1):42)
PLUM (Prunus umbellata) Rust (Tranzschelia prunispinosa var. typica)**	Georgia	Noted in a plum thicket. (PDR 33(1):19)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
STRAWBERRY var. KLONMORE "Variegation" (genetic)	Louisiana	In a one-half acre field of Klonmore strawberries, 75% showed "variegation". (PDR 32(10):442)
DAHLIA Scab (*Actinomyces scabies*)**	North Carolina	Found on dahlia roots. Disease noted on only two of fifteen varieties grown. (PDR 32(10):449)
AFRICAN VIOLET Meadow nematode (*Pratylenchus* sp.)**	Maryland	Found on two plants of the "Ionantha" variety.
Root knot (*Heterodera marioni*)**	Maryland	Found on a plant of the "Plum" variety. (PDR 32(6):256)
OAK (PIN AND RED) Root disease, nematodes associated *Hoplolaimus coronatus*** possible cause and meadow nematode (*Pratylenchus* sp.)** also found.	Delaware Delaware District of Columbia	First noticed in 1943. 50 to 60% of pin oaks in Wilmington showed symptoms. Definitely found only in Wilmington but symptoms also noticed in D.C., Md., Pa., and N.J. (PDR 33(3):132-133)

DISEASES OF CEREAL CROPS

AVENA SATIVA. OATS:

In Arkansas, H. R. Rosen reported that the fall of 1947 was very dry and this had much to do with late planting, poor seed bed preparation, and poor stands. Nevertheless, there was a 5 percent increase in total oat acreage over 1946-47 and a continued shift from spring to winter oats. Arkansas oat growers have largely turned to growing winter oats, and he stated that this shift has probably occasioned a marked change in the kind and prevalence of both nonparasitic and parasitic diseases. However, so far as the general pathology of the crop is concerned, the change in varieties has perhaps as much to do with changes in disease prevalence as the shift from spring to fall planting. Rosen pointed out that the 1948 data on diseases, based in part on a 2,000-mile survey of oat diseases conducted in May and June, is in line with previous findings relative to the unimportance of Helminthosporium blight compared with anthracnose and Helminthosporium leaf spot in Arkansas.

1948 marked the third successive year in which anthracnose (Colletotrichum graminicolum) was very common and probably the most destructive parasitic disease. During the survey not a single oat field was found that did not show considerable anthracnose. Last year a conservative estimate of reduction in yield due to this disease was given as 5 to 10 percent, and since there was fully as much anthracnose in 1948, the loss this year would not be lower than this. (PDR 33(1):31-35).

Erysiphe graminis, powdery mildew. Varietal reaction of oats to powdery mildew as observed in Virginia was reported by Curtis W. Roane. (PDR 32(9):391).

Fusarium nivale, snow mold. C. M. Haenseler reported that following a severe outbreak of snow mold on winter oats in February 1948, at the New Jersey Agricultural Experiment Station, Forkadeer, Lee, Pioneer, Stanton, Traveler, Winter Turf, Wintok and CI4316 were tested for resistance on plots replicated three times. Traveler showed a total of 110 snow mold spots and Winter Turf 225, while none of the other varieties showed any infection. (PDR 32(5):175-176)

Helminthosporium victoriae, blight, was reported extremely light in Kentucky as compared to the past two years according to D. A. Smith and L. M. Josephson. (PDR 33(1):36-37). K. Starr Chester reported that the disease became widespread in Oklahoma following a trace last year (PDR 32(7):321). In Arkansas, H. R. Rosen reported that despite the continued increase in acreage of Victoria derivatives, and an increase in Helminthosporium blight, average State yields continued to increase so that 1948, with an average of 32 bushels per acre, represented a rising peak in increased production, which has continued for three consecutive years. It seems that this disease is relatively unimportant in Arkansas as compared with anthracnose and Helminthosporium leaf spot. (PDR 33(1): 31-35)

Puccinia coronata, crown rust, was less prevalent in 1948 in Arkansas than in any previous year recorded. The complete failure to find any crown rust in commercial fields of winter oats was probably due to an exceptionally cold March, a relatively dry April, a very cool first half of May and also a substitution of resistant varieties for the older susceptible types.

Pyrenophora avenae, Helminthosporium leaf spot, in Arkansas seemed next in importance to anthracnose. It was found in every oat field and on every plant examined. British workers have been unable to find any resistant varieties. Taking the State as a whole the estimated amount of leaf area lost was about 10 to 15 percent. (PDR 33(1):31-35)

Red spot mosaic of oats (presumably due to a virus or virus complex) has been observed since 1942 on various oat varieties in Arkansas according to H. R. Rosen. The disease appeared to be most destructive, especially in the spring on winter oats, but a crop that appears a failure may recover within a month and yield as high as 90 bushels to the acre. He stated that field observations of this disease during the past seven years indicate that compared with some other diseases, it is not important economically on the varieties grown at present. No evidence was obtained as to the introduction or transmission of the disease (PDR 32(5):172-175).

HORDEUM VULGARE. BARLEY:

T. T. Hebert and G. K. Middleton reported occurrence of a mosaic disease of barley in a nursery in North Carolina. They state that the disease is probably caused by one or more strains of the wheat mosaic virus. (PDR 32(10):435-436)

Puccinia hordei, leaf rust, in Oklahoma, according to K. Starr Chester, was almost totally absent. (PDR 32(7):321)

Septoria passerini, leaf spot. Chester reported that in Oklahoma barley was more heavily attacked by this disease than at any past time in the memory of many cerealists. (PDR 32(7):321)

TRITICUM AESTIVUM. WHEAT:

R. W. Leukel reported that in April 1948 specimens of wheat collected in Spartanburg County, South Carolina were badly infected with Dilophospora alopecuri, along with some nematode (Anguina tritici)-infected plants. These plants were collected about 40 miles from the infected field found in 1946. Leukel visited the field in May and estimated a loss of about 20 percent in a large part of it. It seemed probable that the disease was introduced by means of infested seed from some distance. The first report of occurrence of this disease in the United States came from a farm in Greenville County, South Carolina in 1946. The farmer stated that he had used wheat from the infected crop for seed in the fall of 1946, but it had been cleaned and dipped in blue-stone solution. No nematode infection was found in either the 1947 or the 1948 crop. Apparently the 1946 treatment along with crop rotation had eliminated the nematode disease and along with it also the Dilophospora disease, since the latter is dependent on the former for its maintenance. (PDR 32(7):291-292)

Puccinia rubigo-vera var. tritici, leaf rust. Chester and Preston made an experimental forecast of wheat leaf rust in Oklahoma for 1948. Owing to a drought in the fall of 1947, the new crop was not planted until November or even December, the usual infection of seedlings by airborne rust spores from the North thus being prevented. Leaves of rust susceptible wheat varieties examined at 10-day intervals from February 1 to March 31, 1948, at Stillwater revealed not a single rust pustule in the seven samplings. An extensive survey throughout the wheat growing counties of the State showed a negligible amount only in the south-western corner of the State (PDR 32(5):176-181). Later Chester reported: "As predicted April 1, this has turned out to be a year of the lightest leaf rust of wheat for at least a decade and possibly much longer". (PDR 32 (7):321).

Tilletia spp., covered smut. By July the 1948 wheat crop in Oklahoma was showing an unusual amount of covered smut according to Chester. In Custer County a 160-acre field was found to be 80 percent infested with smut and was plowed up. Another large field in Harper County also showed 80 percent smut by count. In Grant County fields were infested to the extent of 20 to 35 percent. In Garfield County in many fields combines raised a continuous black fog of smutty spores. The varieties found smutty were Red Chief, Early Triumph, and Early Blackhull wheat. This was said to be the heaviest outbreak in a decade, and is considered the heaviest in the memory of many older wheat growers. Two reasons were given for the 1948 outbreak, (1) growers got careless about using control practices, (2) weather conditions of last fall were ideal for development of a smutty crop. (PDR 32(7):321)

Ustilago tritici, loose smut, was reported present in Kentucky in all commerical fields inspected and infection varied from a trace to 3 or 4 percent. (PDR 33(1):36-37)

DISEASES OF FORAGE AND COVER CROPS

BROMUS INERMIS. SMOOTH BROME:

Rhizoctonia solani. This fungus "causes a disease of Alta fescue lawns and is a limiting factor in the establishment and persistence of smooth brome grass and birdsfoot trefoil in pasture mixtures at Beltsville, Maryland. During the summer seasons of 1947 and 1948, this fungus caused severe damage to spaced plants of fescue and brome grass in nurseries and to turf plots of these grasses in pure stand and mixtures. Trefoil in pure stand and mixtures was also severely attacked. A conspicuous leaf spot symptom was produced on the grasses, and infected plants were weakened and frequently killed outright. Surviving plants of the grasses and trefoil had some ability to recover. Damp, humid, warm weather favored disease development and dense, heavy vegetative growth was most susceptible to invasion by the fungus. The fungus mycelia grew rampant on all foliage parts and infection took place at random." (J. Lewis Allison and others. (Phytopath. 39(1):1)

FESTUCA ELATIOR var. ARUNDINACEA. ALTA FESCUE. See under BROMUS.

LOTUS CORNICULATUS. BIRDSFOOT TREFOIL. See under BROMUS.

LUPINUS SPP. LUPINE:

Ceratophorum setosum, brown spot. J. L. Allison and others reported the results of a lupine disease survey made in March in the Southeastern States; they state that the most serious disease observed was brown spot, reported for the first time in the United States last year. (PDR 32(4): 133). In 1947, nothing was known about its distribution in this country, however, this survey revealed its presence in all localities visited. They give a brief discussion of its symptoms since the disease is so new to our country (PDR 32(5):181-184). (See also Table 1)

MEDICAGO SATIVA. ALFALFA:

Virginia reported an unusual amount of forage crop diseases during 1948. This can be accounted for largely because of the unusually wet, cold period during March and early April and the continuous wet weather in many parts of the State. Ascochyta imperfecta, black stem, was unusually prevalent. The disease started in late February in some parts of the State and continued throughout the summer. Winter injury combined with black stem, and in some cases improper fertilization accounted for the killing of the plants in spots of certain fields. Sclerotinia trifoliorum, stem rot, was a serious disease in the eastern part of the State for several years. In 1948, stem rot was less severe than in past years. Peronospora trifoliorum, downy mildew was present in early spring and late fall, but the damage was small. Ditylenchus sp. stem nematode, caused a new disease in Virginia, on one farm in Henrico County. Four leaf spots were observed and Fusarium wilt was found in several fields. (PDR 33(2):90-91) Also in North Carolina, alfalfa diseases were reported prevalent and more severe than usual during the last two months of 1948. Common leaf spots, yellow leaf blotch, and black stem could be found in many fields in early November. These diseases increased in severity during November to such an extent that by early December defoliation and death of stems was a conspicuous feature in many fields. An unusual number of rainy days occurred in November, more than twice the normal amount of rain having fallen. Likewise the early part of December was rainy and rather warm. These conditions apparently accounted for the severity of these diseases in North Carolina during the last of the year. (PDR 33(2):89-90)

TRIFOLIUM SUBTERRANEUM. SUBCLOVER:

Yellow bean mosaic (virus). Frank P. McWhorter and John R. Hardison reported that seeds of the Tallarook variety of subclover procured from Australia were brought into Oregon by plane in 1947. These seeds were planted in the fall of 1947 near Oregon City. Seeds harvested from this first planting were used, September 1948, to plant a seed increase plot. This plot was ruined by a virus disease and had to be plowed under. Following a course of studies it was concluded that this infection was not introduced on the seed and that the disease was due to local strains of bean virus 2. (PDR 33(2):86-88)

DISEASES OF FRUIT CROPS

FRAGARIA SPP. STRAWBERRY:

Further studies on the cause of strawberry root rot in Oregon were reported by P. W. Miller. The results obtained demonstrate that under Oregon conditions strawberry root rot is not due to a single factor but to several agencies. In addition to the widely distributed and well-established red stele disease (*Phytophthora fragariae*) there are two types of cortical root rots, brown root rot and black root rot. He stated that brown root rot is evidently due to the combined action of certain weakly parasitic fungi and adverse soil conditions, while black root rot is apparently primarily induced by the dessication of the roots during the digging and planting processes and may possibly also be induced by drying under summer drought conditions. (PDR 32(7):315)

According to J. B. Demaree, the strawberry yellows virus disease or xanthosis is rather widely distributed, although unrecognized, in eastern strawberry plantings. The spread of strawberry yellows from diseased to healthy plants is contingent upon the presence of the aphid (*Capitophorus fragaefolii*), the only insect vector of this disease. The distribution of this vector in the Eastern United States is not known, but in the three Pacific Coast States it is widely distributed. It is believed that the greatest concentration of virus-infected plants is in the middle Atlantic States. He described some differences in symptoms between eastern and western occurrence and stated that control in the East will be easier because of the scarcity of the vector. (PDR 32(10):428-432)

MALUS SYLVESTRIS. APPLE:

Venturia inaequalis, scab. R. S. Kirby in summarizing the incidence of apple diseases in Pennsylvania in 1948 as well as for the 20-year period ending in 1948 stated that scab was more severe in 1948 than it had been during any of the 20 years that records had been taken. Other diseases, such as sooty blotch and Brooks spot, which come late in the summer, were below average. (PDR 33(2):99-103)

PERSEA AMERICANA. AVOCADO:

Verticillium albo-atrum. According to George A. Zentmyer a severe wilt and dieback of avocado trees was identified during 1947-1948 as caused by this organism. The fungus was isolated from trees of the Fuerte variety, a budded Guatemalan variety, and Guatemalan seedlings under conditions of natural infection. Affected trees were found on both Mexican and Guatemalan root stocks. Scattered diseased trees were found in all of the commercial avocado districts of California. Some of the affected groves were previously planted to tomatoes. Apparently the disease was previously attributed to excess moisture of the soil. (Phytopath. 39(1):26)

PRUNUS SPP. CHERRY:

Little cherry virus. Carl W. Nichols has given evidence indicating that there may be two strains of the little cherry virus in Idaho. The affected fruit in the northern part of the State exhibited symptoms similar to those found in Washington, while in the southern part the pedicels were shorter, the new growth of trees which have been infected for a number of years showed shortening of the internodes resulting in a rosetted appearance, and the leaves had undulated margins. In a further note the author stated that the first survey for the disease was carried out in the summer of 1948. Of 59,173 trees inspected, 901 were found to be infected, the majority being in Gem, Nez Perce, and Payette Counties. A program for the voluntary removal of diseased trees was initiated (PDR 32(10):433-434). B. L. Richards and others reported that the western "X" virus is a cause of "little cherry" in Utah. "Transmisson studies during the past two years have established the fact that 'little cherry', as it is recognized in Utah, is an expression of the Western "X" virus in the sour and sweet cherries on Mazzard root stock." (Phytopath. 39(1):19)

PRUNUS ARMENIACA. APRICOT:

Xanthomonas pruni, bacterial spot. H. H. Thornberry and others reported observations on bacterial spot in Illinois. In addition to the lesions on peach twigs, some spring canker infections were found on apricots and also on peach nursery seedlings which had been budded but not cut back. This is the first record in Illinois of spring cankers on apricot and nursery seedling peaches. Overwintering of cankers on apricot twigs was also reported. (PDR 32(7):306-307)

PRUNUS PERSICA: PEACH

Glomerella cingulata, bitter rot, was reported by John C. Dunegan and Joyce Kephart on peaches from Maryland and Georgia (PDR 33(1):18).

Taphrina deformans, leaf curl, has been particularly abundant in central and northern California according to Emlen Scott. It was not uncommon to see unsprayed trees with no normal leaves. (PDR 32(8):351). Peach leaf curl caused extensive losses during the unusually wet cool spring of 1948 in the Willamette Valley of Oregon, according to Adin P. Steenland. Most of the curled leaves fell from the trees but a few remained attached. It was on these leaves that the brown rot (Monilinia laxa) sporodochia were found. This is believed to be the first report of sporodochia of Monilinia laxa on leaves. The sporodochia were found on both twigs and leaves in an orchard at Brooks, Oregon. (PDR 33(4):203-204)

Xanthomonas pruni, bacterial spot, see under PRUNUS ARMENIACA.

RUBUS SPP. CANE FRUITS:

Brown berry disease and mild streak of black raspberry (Rubus occidentalis) in the opinion of J. B. Demaree are two distinct virus diseases. The occurrence of the two diseases in the same field or on the same bush is merely coincidental. Inspections of black raspberry fields revealed high incidence of mild streak symptoms with those of brown berry, and brown berry symptoms in the absence of mild streak. He stated that the symptoms of the two diseases can be easily distinguished. Brown berry, as observed by him in Pennsylvania and Ohio, the only two States from which the disease has been reported, causes only one to several fruits in a berry cluster to die during the green stage, they then turn brown and become dry, hard, seedy and cling tightly to the receptacle. Unaffected berries in a cluster ripen normally. The most characteristic symptoms of mild streak do not show until the berries are ripening, when they lack luster, remain small, and are poorly flavored; all berries on infected bushes are diseased. Pulp and juice are reduced, but the berries are not dry and never turn brown (PDR 32(6):251-252). According to reports mild streak is widespread in Maryland blackberry plantings.

DISEASES OF NUT CROPS

P. W. Miller reported on nut diseases in Washington and Oregon in 1948. (PDR 33(1):20-21):

CORYLUS SP. FILBERT:

Xanthomonas corylina, bacterial blight, was widely distributed in 1948, occurring in practically all filbert orchards in western Oregon. It was most prevalent in young orchards, from 1 to 3 years of age, causing the death of many young trees.

Phyllactinia corylea, mildew, occurred in varying amounts in many orchards in western Oregon in 1948. However, it was of no economic importance since the disease did not make its appearance until very late in the season.

Filbert shrivel (non-parasitic) characterized by a shriveling of the kernels, was widely distributed in the Pacific Northwest in 1948, occurring to some extent in practically every orchard in Oregon and Washington.

Leaf scald (non-parasitic) was widely distributed in the Pacific Northwest in 1948. The disease was much worse in orchards located on relatively shallow soils with low reserves of soil moisture.

JUGLANS REGIA: PERSIAN WALNUT:

Armillaria mellea, mushroom root rot, caused the death of a limited number of mostly seedling Persian walnut trees in Oregon in 1948.

Xanthomonas juglandis, blight, was widely distributed in the Pacific Northwest in 1948, causing greater loss than normal. In certain non-sprayed Persian walnut orchards in western Oregon, losses from this disease ranged up to 50 percent of the potential crop. However, for the whole region it was estimated that about 25 percent of the unsprayed crop was either destroyed or affected by the disease.

Leaf scorch (non-parasitic) was widely distributed in the Pacific Northwest in 1948, occurring to a greater or less extent in most Persian walnut orchards in this region. In orchards on certain soil types deficient in boron it was very prevalent. Application of borax in sufficient quantities to the soil generally decreased the amount and severity of this disorder.

Walnut shrivel (non-parasitic). This disorder, Miller reported, was more prevalent and severe in the Pacific Northwest in 1948 than it had been for many years. For the region as a whole it was estimated that about 25 percent of the 1948 crop was affected. It was believed that the occurrence of two weeks of abnormally hot, drying weather at the critical time of filling of the nuts, with accompanying moisture and associated nutritional deficiencies, was largely responsible for this disorder.

DISEASES OF SPECIAL CROPS

BETA VULGARIS. SUGAR BEET:

Puccinia aristidae, rust, was first noticed in Nebraska in 1947. One field near Scottsbluff showed about 2 percent of the plants infected. In 1948 the aecial stage was found in amounts not exceeding a trace. The uredial and telial stages of the fungus were found to be quite prevalent on saltgrass, Distichlis stricta. The diseased sugar beets were found in the vicinity of the rusted saltgrass (M. L. Schuster and W. W. Ray, PDR 33(1):41).

CARTHAMUS TINCTORIUS. SAFFLOWER:

Puccinia carthami, rust, was first observed on breeding material in Nebraska in 1947. A trace of rust was observed on some greenhouse plants during the winter of 1947-1948. In July rust was found in the experimental field plots adjacent to the 1947 plots. Immune plants were observed in introductions from Rumania and Turkey. It is thought that this rust is spread to new areas by seed (C. E. Claassen and others. PDR 33(2): 73-75)

GOSSYPIUM SPP. COTTON:

Rhizoctonia solani, damping off, caused considerable damage to cotton stands in the Mesilla Valley of New Mexico. Leyendecker attributed the unusually high incidence of the disease to the below normal temperatures prevalent immediately following planting. In badly damaged fields random counts ranged from 10 to 85 percent infection. (PDR 32(7):299-300)

NICOTIANA TABACUM. TOBACCO:

Fusarium oxysporum f. nicotianae, Fusarium wilt, is becoming very general over Kentucky where a few years ago it was almost unknown according to W. D. Valleau and S. Diachun. (PDR 32(12):505-507)

Heterodera marioni, root rot, in Virginia, according to S. B. Fenne was much more prevalent this year than in the past several years. This is the first year that a large number of farmers have sent in specimens of rootknot-diseased tobacco. (PDR 33(2):75-76)

Peronospora tabacina, blue mold, of tobacco in the warning service area in 1948 is summarized in Supplement 178, December 30, 1948 (see its index pp. 289-291). Blue mold was first reported late in February in the tobacco growing areas of North Florida, possibly earlier than usual. Warm weather in March and the application of fungicide retarded the activity of the fungus. In the Lower Rio Grande Valley of Texas this fungus was active all through the winter on Nicotiana repanda. In Georgia the disease was observed February 6 in Cook County. The source of infection was thought to have been hold-over on tobacco plants surviving in 1947 beds. All tobacco beds of South Georgia became affected by blue mold during the period February 6 to April 15. Disease spread was slow with no marked peak of activity. Overall plant loss from the unusually light attack was estimated at not over 3 percent of the plants. This was in contrast to 85 percent loss in 1947. Plants were more plentiful in 1948 than any year since 1940. In Tennessee, blue mold was first reported on April 28 in Greene County, becoming widespread throughout East Tennessee and the Cumberland Plateau. Considerable loss for the State, but no acute shortage of plants was reported. In South Carolina, although the disease appeared early (March 15), it spread slowly, and caused little damage in 1948 as compared to 1947 and 1946. Near the end of April blue mold was found in Simpson County, Tennessee, and during the next 10 days it reached central Kentucky. There was a gradual spread until the disease was general but very mild over the entire tobacco growing areas of the State. Blue mold in North Carolina occurred throughout the flue-cured and a part of the Burley area. It was most severe in beds on old sites in all cases. The disease was generally lighter this year than in 1947. In Virginia and West Virginia, blue mold was of moderate severity. In properly sprayed beds it was well controlled.

Blue mold was first observed in Pennsylvania on August 4 in Lancaster County; spread was slow and little loss was incurred. Blue mold damage in New England was very light in 1948, owing to adequate spraying and dusting. Canada reported blue mold in the new tobacco belt of Ontario about the middle of May; a few days later it was noted in the old tobacco belt. During the latter part of the transplanting season the disease was prevalent throughout all Ontario tobacco-growing districts (except east of Toronto), although overall damage was mild owing to the large percentage of growers using control measures. Weather conditions throughout the critical period were not unfavorable for development of the disease. Some field damage was noted in June and July in Ontario. Quebec, the oldest tobacco-growing area of Canada remained free of the disease.

Phytophthora parasitica var. nicotianae, blackshank, continued to spread throughout the State of Virginia, according to S. B. Fenne. It appeared in Sussex and Greensville Counties for the first time this year. The disease is now found in 14 counties. In general, the Vesta strains proved very resistant to blackshank. (PDR 33(2):75-76) E. L. Moore and others reported on black shank, and Bacterium solanacearum, Granville wilt, in North Carolina. They stated that black shank has been spreading with increasing rapidity during the last two or three years and it now occurs in nearly all of the 62 flue cured tobacco producing counties. Eleven counties had from two to four times as many fields infested in 1948 as in 1947. Five counties were so badly infested that it is thought advisable to grow only varieties resistant to the disease. However, varieties that are best from the standpoint of yield and quality have only fair to moderate resistance. On the other hand losses due to Granville wilt in the central and eastern part of the State have been reduced by the use of the resistant variety, Oxford 26, from 50 percent of the crop in certain areas to less than 5 percent. Since black shank is spreading to fields infested with Granville wilt, there is a rapid increase in the overlap of the two diseases. The writers stated that results indicate that it is possible to develop higher yielding wilt resistant varieties, and that wilt and black shank resistance together can be combined with improved yield and quality. (PDR 33(4):183-186)

Pseudomonas tabaci, wildfire. Severe outbreaks of wildfire occurred in both Kentucky and Tennessee according to W. D. Valleau, S. Diachun, and Howard E. Heggestad. In Kentucky this was the most extensive outbreak over the State as a whole that had occurred in over 30 years. The loss in many fields amounted to one-third of the crop. In Tennessee this development has been associated with increased prevalence of the disease in recent years. This year wildfire was present in approximately 75 percent of the burley tobacco fields of East Tennessee. Considering both damage to seedlings and the severe losses in the field, they reported wildfire the most important disease present in this area. (PDR 32(1):505-508)

Thielaviopsis basicola, black root rot. Valleau and Diachun reported that with over 90 percent of the burley crop in Kentucky set with resistant varieties the losses from black root rot were very slight (PDR 32(12): 506).

Streak (virus). According to Valleau and Diachun in some of the North-Central counties of Kentucky, streak was reported as being unusally severe and spreading extensively. (PDR 32(12):506)

DISEASES OF VEGETABLE CROPS

BRASSICA OLERACEA VAR. CAPITATA. CABBAGE:

Xanthomonas campestris, black rot, was reported by H. R. Garriss and D. E. Ellis as being unusually prevalent in North Carolina this season. Infection ranged from a trace to 85 percent of the plants (PDR 32(10): 451). A. H. Eddins reported the worst epidemic of black rot ever recorded for northern Florida during the season of 1947-48. A few fields were abandoned before cutting because of excessive head rot and in some fields almost 100 percent of the plants were affected with black rot at the last cutting. It was found that the disease may be carried over in the soil from one crop to the next. The only cabbage fields free of black rot were those set with plants grown in non-infested soil from black-rot-free seed (PDR 32(7):319). Outbreaks of this disease in Mississippi were both numerous and severe in the early spring of the past two seasons, according to Douglas C. Bain. Observations indicated that most of the outbreaks originated in plants grown from diseased seed. (PDR 32(9):396)

W. D. Valleau and Stephen Diachun described a leaf spot of seedling cabbage growing in a hotbed on the farm of a market gardener in Kentucky. The leaf spot was associated with unbalance of nitrogen and phosphorus. (PDR 32(5):193)

CAPSICUM FRUTESCENS. PEPPER:

Peronospora tabacina, downy mildew, was reported on pepper in Florida by W. B. Tisdale. Two farmers brought the material to his laboratory on March 1 and 2. The disease was generally distributed over the beds. (PDR 32(4):130)

Ring spot (virus). Over 50 percent of the pepper plants in a field in Massachusetts showed what appeared to be tobacco etch virus. The pepper bed was adjacent to the tobacco bed, both having grassland and weeds adjacent. (PDR 32(12):518-519)

Sclerotium bataticola, charcoal rot, was described by P. A. Young as causing a wilting of pepper plants in 5 fields of the California variety of bell pepper near Troup, Texas. One to 20 percent of the plants were wilting or dead with a disease of previously unknown cause. The fungus was found in the xylem of the bases of nearly all the tap roots of the cuttings. (PDR 32(11):482)

CUCURBITS. CUCUMBER, MELON, SQUASH:

Erysiphe cichoracearum, powdery mildew. The occurrence of this mildew seems rare in Florida according to G. K. Parris, who reported a case observed this year (PDR 32(7):301).

Fusarium solani f. cucurbitae, root rot, developed in "Crook Neck" yellow squash grown for seed in Oregon, according to Frank P. McWhorter, who stated that it was serious in the affected field (PDR 33(1):10).

Alternaria cucumerina, leaf spot, appeared on cucumber foliage near Scappoose, Oregon in 1946, and 1947 and again in 1948 a severe outbreak occurred on the Marketer variety near Eugene, Oregon, according to McWhorter (PDR 33(1):10).

Pseudoperonospora cubensis, downy mildew, of cucurbits is summarized in Supplement 178, December 30, 1948 (see its index pp. 289-291). The northward spread of this disease in 1948 was rather slow, it having first appeared in February in the Everglades area of Florida on squash and cucumber plantings. Its development was checked in Virginia by the dry weather, but it gradually moved northward after a three-week interval at a time when harvest was already underway thereby causing little damage. It was reported as far north as Massachusetts. There were no reports from New Jersey, New York or Connecticut, but occurrence was reported in Tennessee. The hot dry weather and the use of sprays and dusts checked the spread and severity of the disease. Estimated losses were low.

Mosaic, (virus). Glenn S. Pound reported that for the last three years, watermelon and muskmelon plantings in a south central Wisconsin area were affected with a virus disease. Ten percent of watermelon plants were infected in some fields. In certain symptoms, properties, and host range, the virus appeared similar to the tobacco ringspot virus. (Phytopath. 39(1):19)

The PDR Supplement 180, dated January 30, 1949 is devoted to "Cantaloup Mosaic Investigations in the Imperial Valley." The University of California and the U. S. Department of Agriculture in cooperation with the Cantaloupe Pest Control Committee of the Imperial Valley, have undertaken a joint project designed to investigate all phases of the cantaloupe mosaic disease. This disease has caused damaging losses to the cantaloupe growers of the Imperial Valley during the past three years and threatens to become a major disease in other producing areas of the Southwest. The results of preliminary investigations by staff members assigned to the project are reported in this Supplement.

LACTUCA SATIVA. LETTUCE:

Aster yellows (virus) was reported by J. G. Leach as a limiting factor preventing the establishment of lettuce growing in the Canaan Valley of

West Virginia. (PDR 32(10):451)

LYCOPERSICON ESCULENTUM. TOMATO:

Phytophthora infestans, late blight. Paul R. Miller points out that the devastating epidemic of tomato late blight in 1946 led to a demand for an effective forecasting service, which was established in February, 1947 by the Plant Disease Survey, covering 32 eastern States. The successful operation of this service resulted in the authorization of the Research and Marketing forecasting project which now functions as a warning service for late blight of potatoes as well as tomatoes and downy mildew of cucurbits (Pseudoperonospora cubensis) and downy mildew of tobacco (Peronospora tabacina). These diseases are widespread in the eastern part of the United States in which the project is now operating as in 1947. This region has been divided into three smaller regions, the northeastern, southeastern and north-central with a State Experiment Station in each region serving as headquarters. The service operates through key pathologists designated to work with it in each State and each cooperating Province in Canada. The key men send reports on dates and places of first appearance, weather of the past week, spread of disease to new areas, and losses incurred. The reports are promptly assembled by the Plant Disease Survey into a warning letter and sent to the key reporters and the Agricultural Insecticide and Fungicide Association. The key pathologists are responsible for making this information available and issuing control measures (PDR 32(5):160-166). Tomato late blight in the warning service area in 1948 is summarized in Supplement 178, December 30, 1948 (see index pp. 289-291). In certain localities the disease as a whole seemed more severe than in 1947, perhaps it was more scattered; however, it followed the Atlantic Coast States and extended into the tomato canning areas in some midwestern States. Owing to control methods by adequate spraying or dusting and the hot dry weather the disease did not reach the epidemic proportions of the 1946 late blight attack. Losses ranged from 2 to 40 percent of the acreage planted. In spite of these losses a good crop was grown.

R. A. Hyre discussed trapping sporangia of Phytophthora infestans as an aid in forecasting the development of late blight. "A series of 8 spore traps was established from Virginia to Rhode Island. The traps consisted of 1 x 3 inch vaselined slides held in a vertical position in a vane, and changed daily. In a period of about two months, 13 sporangia were trapped, with some question as to the identity of five of them. Late blight always occurred within 12 miles of the traps prior to the time the sporangia were caught. These data indicate that the traps were of little practical value for forecasting the early occurrence of late blight in 1948." (Phytopath. 39(1):10)

Blossom-end rot. James G. Horsfall described conditions accompanying an unusual occurrence of tomato blossom-end rot in Connecticut, on July 8. Ecological conditions that brought on the disease were at the opposite pole from the normal. (PDR 32(8):351)

Spotted wilt (virus) in Nebraska was limited to Lincoln and its suburbs in 1948, according to A. F. Sherf. Certain weeds and ornamentals are suspected as overwintering hosts of the virus. In one 20-acre field in which 50 to 60 percent of the plants developed spotted wilt, the severest infection occurred adjacent to small patches of field bindweed. (PDR 32(1):509)

PHASEOLUS VULGARIS. BEAN:

Botrytis cinerea, gray mold. Leo Campbell reported that an unusual amount of rain during the growing season was responsible for serious damage from gray mold to Blue Lake beans in western Washington. (PDR 33(2):91)

Sclerotinia sclerotiorum, white mold, according to Vaughan and Dana has been recognized in the Pacific Northwest for twenty-five years as a disease of minor importance on a wide variety of hosts including some vegetables. More recently intensive culture under irrigation of vegetables for processing has favored the increase of this disease in such a crop as the Blue Lake type of pole beans. Because of the actual and potential importance of this disease on beans a joint program of investigations was initiated in 1947 by the Oregon Experiment Station and the U.S. Department of Agriculture. In tests of various materials used as sprays or dusts to control white mold on Blue Lake beans, bismuth subsalicylate gave marked reduction of aerial infection; of interest also is the observation that control of basal infections and of aerial infections was roughly parallel. (PDR 33 (1):12-15)

RAPHANUS SATIVUS. RADISH:

Fusarium oxysporum f. raphani, wilt, was observed and recognized for the second time in California, (the first in San Benito County in 1934) in one planting in Monterey County, in 1948, causing heavy loss. (PDR 33 (1):9)

SOLANUM TUBEROSUM. POTATO:

Bacterial red xylem disease. In Maine, according to Folsom, Getchell and Bonde potato tubers showed at harvest time and in storage a reddish discoloration of the xylem and often a depressed but not discolored, corrosion of the tissue at the stolon scar, caused by an unnamed bacterium the characters of which they describe. The pathogen has been isolated from various parts of infected tubers, which are often of a large size. The data indicate that the organism often enters the tuber through the parent plant, but the perpetuation of the disease through the infected seed tubers could not be demonstrated, because the pathogen disappears from the xylem during the storage period. (PDR 32(6):230-231)

A. H. Eddins in his annual report on incidence of diseases in the Hastings, Florida, potato-growing section reported that the excessive rainfall of 5.08 inches from January 21 to 24 during the middle of the planting period water-logged the soil and much seed was destroyed by soft rot (Erwinia carotovora) in several thousand acres. (PDR 32(7):302)

Wilt, cause not determined. Wilts, caused by Fusarium oxysporum and Verticillium alboatrum, according to Karl H. Fernow, are usually assumed to have less relationship to seed than to soil. He stated that a wilt of Cobbler and Sebago in New York appeared to be definitely related to the seed. Tubers in affected hills showed a superficial hydrosis extending from 1 mm. to 1 cm. into the flesh. These spots were visible from the outside. They occured near the eyes and at the seed end. It is believed that this symptom has not previously been reported in connection with any potato wilt disease. (PDR 32(10):450)

Phytophthora infestans, late blight, of potato in the warning service area in 1948 is summarized in Supplement 178, December 30, 1948 (see its index pp. 289-291). Potato late blight was found in the fall crop of potatoes in Louisiana, in December it was found in Florida. Its origin was traced in many instances to diseased seeds, cull piles, and infection from tomato plantings. The disease was not severe in 1948, however, it was, perhaps more scattered following the Atlantic Coast States, and was found in Louisiana, the Ohio Valley States, Great Lake States, Iowa, North and South Dakota, eastern Canada, and an isolated plave in British Columbia. Dry weather, and adequate dusting and spraying prevented widespread development of the disease. Losses ranged from 1 to 20 percent; on the whole they did not exceed in many cases those for 1947.

W. J. Martin reported on strains of Phytophthora infestans capable of surviving high temperatures. "Attempts to explain the unusual occurrence in recent years of late blight in the fall crop of Irish potatoes in Louisiana led to a study of the reaction of the different isolates of Phytophthora infestans to high temperatures. Cultures of the different isolates on navy bean infusion agar were exposed at 36°C. for varying times. After exposure, the cultures were kept at 20°C. for several days after which transfers were made to determine whether they were still viable. Eight different isolates were used, including four from Louisiana, three from Minnesota, and one from Cornell. The maximum time survived by the isolates was as follows: The four Louisiana isolates, 6 days; the three Minnesota isolates, 4 days; and the Cornell isolates, less than 6 hours." (Phytopath. 39(1):14)

Avery E. Rich reported marked differences in resistance to late blight attack in potato variety trial plots at the Northwestern Washington Experiment Station. He stated that it is possible that the variations obtained here from those obtained in other parts of the country might be due partially to the presence of different strains of the pathogen. (PDR 33(1):11)

ZEA MAYS var. SACCHARATA. SWEET CORN:

Pseudomonas stewarti, bacterial wilt or Stewart's disease. A. W. Poitras and N. E. Stevens published reports of experienced observers on bacterial wilt of sweet corn for the years 1945-1948. For these years, available evidence indicated that the abundance of bacterial wilt is closely correlated with the temperature of the preceding winter, as was the case during the years of their earlier observations (PDR 33(3):161-165). G. H. Boewe presented data indicating that the late or leaf blight stage may develop to cause severe loss following lower winter indexes than are required for the early or wilt stage of the disease. Data indicated that a moderate to severe leaf blight epidemic may develop when the winter index has been 85 or slightly above, that light epidemics may occur when the winter indexes lie between 80 and 85, and that only a trace or no disease may develop when the winter index is below 80. (PDR 33(4):192-194)

DISEASES OF ORNAMENTALS

AZALEA:

Ovulinia azaleae, azalea flower blight, was conspicuous by the absence of sclerotia on blighted azalea flowers in the Baton Rouge area, Louisiana (May 17), according to A. G. Plakidas. This is in contrast to what occurred last year when every blighted flower, on the bush or on the ground, had from one to several sclerotia on it. He stated that it will be of interest to note what effect the failure of sclerotial development will have on the incidence of the disease next year (PDR 32(7):320). An outbreak of flower blight occurred in Gainesville, Florida during the third week of March following an 8 inch rain during the first 10 days of the month according to G. F. Weber. He stated that this outbreak was an expected response of this fungus under almost ideal conditions of humidity and temperature. The spread of the disease was rapid. There was no visible difference in resistance or susceptibility detected. (PDR 32(5):194)

Yellowing and necrosis (undetermined). According to D. L. Gill this trouble has been observed for the past two years in the South. The disease was rather widespread in 1948 as compared to 1947. In two fields approximately 90 percent of the plants died, while the remaining ones were inferior. Diseased plants were observed in North Carolina, Georgia, Alabama, Mississippi and Louisiana. The symptoms of the disease are described. Several possible causes of the trouble -- drouth, nutritional deficiency, soil infesting organisms, virus, soil acidity, and insecticide toxicity -- have been considered. (PDR 33(4):202)

CHRYSANTHEMUM SPP.

Deuterophoma spp. Kenneth F. Baker and others reported the association of two undescribed species of Deuterophoma with the obscure stunt disease of chrysanthemum in California. The chrysanthemum stunt disease has become generally important over the United States since 1946. No definite causal agent has yet been found, but it is generally considered to be a virus. (PDR 33(1):2-8)

DIANTHUS CARYOPHYLLUS. CARNATION:

Fusarium poae, bud rot, was found in early December 1948 in a carnation greenhouse at Kennett Square, Pennsylvania. The disease was present on Joan Marie and Northland Varieties. Many buds of the Joan Marie variety were rotted and considerable loss in this variety was being experienced by the grower. One infected bud was found in the variety Northland. Mites (Pediculopsis graminum) described as always associated with the disease were present. This disease is seldom found. (W. D. McClellan, PDR 33(3): 136)

GLADIOLUS SPP.

McWhorter reported that as far as he knows Curvularia leaf spot of gladiolus has not been found in Oregon. During the 1948 season intensive surveys of diseases of gladiolus were made in all parts of the State where gladiolus are grown. (PDR 33(4):207)
(See also Table 1)

The influence of climate on incidence of Fusarium rot and dry rot in gladiolus corms is discussed by C. J. Gould. "Fusarium rot (F. oxysporum f. gladioli) the most troublesome disease of gladiolus corms in eastern and southern United States, is also severe in eastern Washington, but uncommon in western Washington except on recently introduced stocks. Dry rot (Sclerotinia gladioli) is the most important corm disease in the latter area. To study the role that climate plays in the development of these two diseases, corms of the variety Picardy were obtained from a stock that was severely infected with both diseases. Apparently healthy unhusked corms were selected from this stock and grown in the comparatively cool climate of western Washington at Puyallup, and in the warmer climate of central Washington at Sunnyside. At harvest, 76 percent of the nontreated western Washington-grown corms had dry rot and 5 percent had Fusarium rot. Comparable figures for the eastern Washington-grown corms were 17 percent and 32 percent, respectively. Temperature is believed to be the primary factor responsible for these differences. Average temperatures from May through September were 60°F. at Puyallup and 67°F. at Sunnyside. These results and previous observations indicate that rotation between different climatic areas might be a useful supplement to standard measures for controlling dry rot and fusarium rot in commercial gladiolus corms." (Phytopath. 39(1):8).

Stemphylium sp., leaf spot, described by Robert O. Magie, has caused loss to cut-flower growers in Florida annually during the past ten years. Two-thirds of the acreage was planted to one of the susceptible varieties, Picardy. Fungicides have not provided complete protection from this disease. (PDR 32(8):344-345)

PRIMULA MALACOIDES. PRIMROSE:

Enation disease. Frank P. McWhorter and W. C. Price reported an enation disease of primrose, cause unknown, in a Conservatory at Pittsburgh, Pennsylvania. In the case of peas, where the cause is known to be a virus, most of the enations originate on the under side of the leaves whereas the primrose enations observed always arose on the upper surface. The plants showing crenate veins were among a planting of about a thousand that were grown in pots in fresh potted soil. The history of the planting indicates that the disease was introduced in the seed. (PDR 32(8):345)

DISEASES OF TREES

ACER MACROPHYLLUM. BIGLEAF MAPLE:

According to Wagener and others a disease of undetermined cause was first noted in 1944 on the Lassen National Forest in California. Since 1946, it has been abundant in the northern Sierras, the Sacramento and Klamath River drainages, and throughout the coast mountains of northern California. In 1947 and 1948 the disease was prevalent in the upper Rogue River area of southern Oregon, and in 1948 was observed to be widespread in the Umpqua National Forest of southwest Oregon. The symptoms of the disease suggest that a virus might be responsible. (PDR 33(4):195-197)

ARBUTUS MENZIESII. PACIFIC MADRONE:

In the spring of 1948, considerable damage to Pacific madrone by foliage diseases was noted at several localities in the Siskiyou Mountains of northern California. The greatest amount of tree killing was observed in the vicinity of Happy Camp on the Klamath River. However, some tree killing and extensive foliage killing was observed in other localities of northern California and southern Oregon. Wagener and others named several fungi found on the diseased foliage. They considered Cryptostictis arbuti and Didymosporium arbuticola the most important. However, Rhytisma arbuti was prevalent on the affected leaves and some Mycosphaerella arbuticola was found. (PDR 33(4):195-197)

CORNUS FLORIDA: FLOWERING DOGWOOD:

Botrytis leaf and flower blight was reported in the Metropolitan New York area by P. P. Pirone. This was among the more unusual fungus diseases of trees that appeared this spring, which was the wettest spring in seventy-seven years. The disease caused much concern to owners of dogwood trees, most of whom reported they had never seen this disease before. (PDR 32(8):349-350)

Elsinoë corni, spot anthracnose. R. A. Jehle and Anna E. Jenkins listed new records of this disease found on flowering dogwood in Maryland, Delaware and Virginia on a roadside survey conducted in 1948. (PDR 33(4):198-201)

EVERGREENS:

Winter injury. In Wisconsin, according to the State Department of Agriculture, never within the memories of some of the oldest nurserymen have they witnessed such a disastrous winter as was the 1947-48 one. A State-wide survey conducted by the Department revealed that hundreds of thousands of dollars damage had been done. The injury was prevalent throughout the Lake State Regions. Practically every species of evergreens suffered the ravages of this winter catastrophe. The Department stated that danger of winter injury to ornamental evergreens can be reduced by making certain that the ground is thoroughly soaked with water before it freezes in the fall and by applying a mulch during the late fall to avoid deep freezing of the soil. (PDR 32(9):394-395)

MAGNOLIA SPP. ORIENTAL MAGNOLIAS:

Microsphaera alni, powdery mildew, has been observed in nurseries in the vicinity of Mobile, Alabama, during the past three years. Frequently no infection can be found on M. soulangeana growing beside severely affected M. liliflora. The disease has not been seen on M. stellata. Nurserymen control the disease by the use of copper sprays, usually Bordeaux mixture. (D. L. Gill, PDR (4):203)

PINUS ECHINATA. LITTLELEAF PINE:

Phytophthora cinnamomi, W. A. Campbell reported P. cinnamomi associated with the fine roots of little leaf-diseased shortleaf pine in Georgia and South Carolina. This is particularly interesting in view of Copeland's (O. L. Copeland. Some relations between soils and the littleleaf disease of pine. 4 p. ms. to be submitted to Journal of Forestry) observations that the disease is most serious on soils with poor internal drainage. Littleleaf is a widespread and locally serious disease of shortleaf pine in the Southeast (PDR 32(11):472). In a further note, Campbell described a method of isolating P. cinnamomi directly from the soil. (PDR 33 (3):134-135)

PINUS PONDEROSA. PONDEROSA PINE:

Unusual prevalence of some foliage diseases on forest trees in the Pacific Coast States during the last few years, accompanying abnormally cool and wet spring seasons are reported by Willis W. Wagener and others. Elytroderma deformans developed in severe form on ponderosa pine in many localities east of the Cascade Mountains during the last three years, particularly in the Ochoco and Whitman National Forests. (PDR 33(4): 195-197)

PSEUDOTSUGA TAXIFOLIA. DOUGLAS-FIR:

Rhabdocline pseudotsugae, the needle fungus was very prevalent on the foliage of young trees of Douglas-fir in northern Idaho and northwestern Montana in 1947 and was responsible for much of the excessive dropping of needles from the Christmas trees. In 1948 the disease was even more severe. (Wagener & others, PDR 33(4):195-197).

QUERCUS SPP. OAK:

Hoplolaimus coronatus. Association of this nematode with a new root disease of oaks in Delaware was reported by Viggars and Tarjan. They stated that plantings of pin oak, *Quercus palustris*, have been observed severely affected by a new and extremely virulent trouble in Wilmington, Delaware. As early as 1943 symptoms of the condition were apparent and have increased in severity until roughly 50 to 60 percent of the pin oaks there are showing symptoms. The red oak, *Q. rubra* is also affected, but not so severely as pin oak. The symptoms of the disease are described. The authors also reported the finding of meadow nematodes (*Pratylenchus* sp.) in pin oak, a new host for this pathogen, at Wilmington, Delaware. This discovery was substantiated by the finding of meadow nematodes also in oak roots in the District of Columbia by Mrs. C. Lewis, of the Division of Nematology. (PDR 33(3):132-133) (See also Table 2)

SALIX SPP., WILLOW:

Fusicladium saliciperdum, scab, was reported by M. C. Richards and A. R. Hodgdon as being responsible for severe defoliation of willow trees in New Hampshire (PDR 32(11):483).

THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

AGRICULTURAL RESEARCH ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 185

PRELIMINARY ESTIMATES OF ACREAGES OF CROP LANDS IN THE UNITED STATES INFESTED WITH SOME ORGANISMS CAUSING PLANT DISEASES

Supplement 185 August 1, 1949

PLANT DISEASE REPORTER SUPPLEMENT

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

PRELIMINARY ESTIMATES OF ACREAGES OF CROP LANDS IN THE UNITED STATES INFESTED WITH SOME ORGANISMS CAUSING PLANT DISEASES

Compiled by Paul R. Miller and Nellie W. Nance
from reports of Collaborators of the Plant Disease Survey

Plant Disease Reporter
Supplement 185 August 1, 1949

FOREWORD

Last fall (1948) the Plant Disease Survey asked its Chief Collaborator in each State for an estimate of the area of crop land infested by various plant pathogenic organisms. There are obvious reasons why it is important to have such estimates, but the difficulty of obtaining them is equally clear.

Except, perhaps, locally and spasmodically or for special purposes, no attempt had been made to measure the area of infested land. This meant that, in most cases, the Collaborator had to base his estimate on what was known about loss to crops from these diseases in relation to the land potentially available for these crops. This would give a "working figure", which is all these preliminary estimates can claim to be.

On the other hand, both plant pathologists and industrial workers need the background that only some numerical statement, tentative though it may be, can supply. Effective soil treatments have been devised for nematode control, and it is likely that in the near future equally effective chemicals will be found to control at least some of the soil-borne fungi. It is vitally necessary that manufacturers should be able to gauge potential requirements, in order to plan in the beginning for economical production and distribution of different types of chemical treatments, instead of proceeding blindly in hit-or-miss fashion. Farmers also would benefit from realistically planned production, since it would enable manufacturers to set prices within ranges effective for everyday practical use, not merely for experimental trial or for exceptional purposes. Future evaluation of effectiveness and results of such treatments or other control measures depends on our present knowledge.

Although these are the most compelling reasons just now, there are others, e. g., as a starting-point to determine the amount and rapidity of spread, or as a basis for judging the effect of soil infestation on land values or on crop industries, or others. We cannot tell at present what will be the most important future use for such estimates, but we can put them on record now, while it is still possible to obtain them.

Twenty-eight States responded with some sort of estimate. In their replies, some Collaborators remarked that the request for definite statements of infested acreages furnished an opportunity and a reason for more concrete thought upon this subject than they had ever given it before.

Others, however, as always happens when estimates are asked for, wrote that they could give no figure reliable enough to be of any use. In many cases it is true that there is simply no information on which to base an estimate. In others, there is the personal feeling that no figure is useful unless it is exact. This feeling is to be respected, as leading to careful accurate work where exactness is required. But it does not allow for the times when even an incomplete estimate now is more useful than any number of exact measurements at some future time. If we always wait for exact figures on such a question as this one, we must expect to suffer from chronic standstill in much of our work.

There must be a starting point . Tentative estimates should not be misleading if their incompleteness is allowed for in any use that is made of them, and if they are used only where such estimates are truly appropiate.

It is as a starting-point only that we put these estimates on record. They will be subject to constant revision as information accumulates. It is our hope that somebody at some future time will be able to compile more complete and exact figures.

The results have been summarized in Tables and Maps giving the estimated acreage in the States reporting land potentially available for particular crops infested with some of the more widespread pathogenic soil-borne organisms.

It must be remembered that the Tables and Maps have been compiled from the reports received and refer only to the States cooperating. The figures for each State are based on the best information available to the Collaborator. In some States this information is more complete than in others. Obviously, the estimates often overlap, that is, the same land may be infested with more than one organism.

We cannot emphasize too strongly that these figures must, in practically all cases, be considered as tentative guesses, not as measurements; as a foundation to build on; not for use where exact accuracy is required, but extremely useful as indicators.

To sum up, repeat, and stress again, these estimates are working tools, not a completed task.

We take this opportunity to thank those of our Collaborators who cooperated so fully in this difficult task. They bear the major part of the responsibility, but also, we fully believe, they will be glad to have had a part in such a useful project. All the credit is due to them. Their names are given below.

Those reporting:

ALABAMA
W. H. Greenleaf
Vernon G. Perry
A. L. Smith
Coyt Wilson

ARKANSAS
E. M. Cralley
Jos. P. Fulton
Curtis L. Mason
V. H. Young

CONNECTICUT
A. E. Dimond

DELAWARE
J. W. Heuberger

GEORGIA
Julian H. Miller

ILLINOIS
G. H. Boewe
M. B. Linn
L. R. Tehon

KANSAS
E. D. Hansing

KENTUCKY
W. D. Valleau

MAINE
D. Folsom

MARYLAND
C. E. Cox
W. F. Jeffers
R. A. Jehle

MASSACHUSETTS
O. C. Boyd

MICHIGAN
D. Cation
J. H. Muncie
Ray Nelson
M. C. Strong

MINNESOTA
Carl J. Eide

MONTANA
H. E. Morris

NEVADA
O. F. Smith

NEW HAMPSHIRE
M. C. Richards

NEW JERSEY
C. M. Haenseler

NEW YORK
Charles Chupp

NORTH DAKOTA
W. E. Brentzel

OKLAHOMA
K. Starr Chester

PENNSYLVANIA
R. S. Kirby

RHODE ISLAND
Frank L. Howard

SOUTH DAKOTA
C. M. Nagel

TEXAS
A. A. Dunlap

VIRGINIA
S. A. Wingard

WEST VIRGINIA
C. F. Bishop
J. G. Leach

WISCONSIN
R. E. Vaughan

WYOMING
G. H. Starr

Tables and maps summarizing the reports follow.

Starred figures in the tables have been interpolated by the compilers, from the Collaborator's report and acreage given in the U. S. Department of Agriculture, Agricultural Statistics for 1947.

Table 1. Estimated potential acreage of crop land infested with *Fusarium*, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
ALFALFA AND TIMOTHY		
South Dakota	381,000	
ASPARAGUS		
Massachusetts	1,000	
BARLEY		
Illinois	23,000[1]	231,300 acres average in 1929-38.
North Dakota	2,638,000	
Wisconsin	25,000	50,000 acres affected earlier. Resistant varieties caused decrease.
BEAN		
Arkansas	9,200	
Connecticut	Trace	
Illinois	17,900[2]	This figure for 1948: for 1929-38[2] it was 14,800 acres.
Kentucky	---	Garden beans are commonly affected by *Fusarium* root rot in farmers' gardens all over the State.
Maryland	5,000	
Massachusetts	100	More intensive cultivation of crop has increased the affected acreage 50 acres over earlier years.
Montana	20,000	
New Jersey	4,000	Increase from only traces earlier.
New York	---	*Fusarium* dry root rot in the same areas outlined for cabbage yellows. Occurs in these areas whenever long rotations with other crops are not practiced. Has not changed much for at least 30 years, except that it has pushed farther south in the western part of the State.

[1] Acreage planted in 1947.
[2] Potential bean acreage affected. Estimated acreage planted in 1948 1,700; average 1929-38 1,570.

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Bean cont.)		
Oklahoma	65	5% of bean acreage
Pennsylvania	144	Loss 5% in 1932-39, 3% in 1940-45. Likely that less than 144 of the 4,800 acres affected
Rhode Island	0	
Texas	Trace	
Virginia	7,000	
West Virginia	25	
Wyoming	900	Has increased with continued cropping (irrigated farms primarily). Definitely worse in 1948 than in previous years.
CABBAGE		
Arkansas	---	No data; very little commercial crop.
Connecticut	200	
Georgia	---	In a few mountain counties
Illinois	1,500	Estimated acreage planted 3,000, 1948 Same as in 1929-38. All cultivated land in the State is infested with *Fusarium*.
Kansas	Over 75%	It is estimated that over 75% of land used for commercial cabbage production is infested with cabbage yellows *Fusarium*. Losses in recent years, however, have not been serious, largely because of yellows-resistant varieties.
Kentucky	---	There has been some yellows in the Louisville area.
Maryland	500	
Massachusetts	100	Use of resistant varieties has reduced the affected acreage from earlier 300
Michigan	250	Disinclination to use resistant varieties
Minnesota	200	Common near St. Paul and Minneapolis, but less common in Freeborn and Carlton Counties.
Montana	---	Present; of no economic importance
New Jersey	1,000	Some of the *Fusarium* problems are acute in specific areas where poor crop rotations are used. Widely distributed but only traces of injury result until

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Cabbage cont.)		
New Jersey (cont.)		the population is built up through continuous cropping with a susceptible crop.
New York	---	About one-third of the cabbage acreage of all the area in the western part of the State known as high-lime area. This extends from northern Chautauqua County eastward, north of southeast Erie County, north of the lower half of Wyoming, Livingston, Ontario, and Seneca Counties, It also touches Yates, and just a trace of the northernmost part of Cortland County. The area from Syracuse east includes the Cherry Valley area or about 10 miles on each side of the Erie Canal, then down the Hudson on an equally wide area, then all of Long Island. One-third of this total area equals about one-fourth of the cabbage acreage of the entire State. This disease was not knowingly present upState before 1914.
North Dakota	100	
Pennsylvania	1,000	1936-1940 loss 11%; 1942-48 loss 2%. More resistant varieties grown. 10,977 acres of cabbage grown in State.
Rhode Island	---	Yellows in some years
Texas	Trace	
Virginia	3,000	
West Virginia	1,000	Use of resistant varieties has reduced the acreage from 25,000 in 1910.
CANTALOUPE		
Maryland	1,500	
CELERY		
Connecticut	0	

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Celery cont.)		
Illinois	---	No acreage data available. Celery acreage very small.
Massachusetts	100	
Michigan	2,000 - 3,000	
Minnesota	Trace	
Montana	0	
New Jersey	50	See cabbage
New York	2,275*	Present in all areas where celery is grown intensively. This includes probably half the total acreage of celery in the State. Most of the spread has occurred during the past 25 years.
Pennsylvania	5	Less than 1%; less than 5 infested acres out of the 550 grown.
Rhode Island	0	
Texas	0	
CEREALS		
Arkansas	25,180	
Illinois	13,445,000	100% in 1947. In 1929-38 15,209,700 acres (100%) affected.
Montana	4,500,000	Fusarium and Helminthosporium
North Dakota	10,000,000	Hard wheat 6,665,000 Barley 2,638,000 Corn 1,141,000
Pennsylvania	---	1 to 2% loss. Earlier 2 to 5% loss, mostly where no rotation. Rotation and seed treatment have reduced the loss.
South Dakota	8,709,000	Barley crop in particular -- the acreage is dwindling because of soil-borne diseases. Also includes winter wheat, spring wheat, durum wheat.
Texas	0	
Virginia	400,000	
Wyoming	100	10 to 20 years ago 200 acres. Continued cropping of dry land farms has reduced acreage planted.
CORN		
Illinois	8,696,000	8,949,500 in 1929-38. All cultivated land in the State infested with Fusarium
Kansas	3,154,000*	Fusarium pink rot (F. moniliforme)

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Corn cont.)		
North Dakota	---	See cereals
South Dakota	4,500,000	
Virginia	1,000,000	
Wisconsin	600,000	300,000 acres previously
COTTON		
Alabama	140,000	No evidence of increase in past 10 years
Arkansas	114,750	This figure is based on 5% of the total cotton acreage. We consider this figure as covering visibly affected fields but we think that every cotton field except those on newly broken land may have enough so that it could be found if the plants were carefully examined.
Georgia	2,000,000	Acreage probably increasing. Fusarium wilt of cotton is all over south Georgia and is in most of the sandy parts of north Georgia.
Illinois	4,000	All cultivated land in the State is infested with Fusarium. Acreage planted in 1947, 4,000; average 1934-43, 4,500
Oklahoma	85,000	5% of cotton acreage
Texas	30,000	
Virginia	1,000	
COWPEA		
Arkansas	12,000	
Connecticut	0	
Georgia	---	Widespread in fields. Cowpea wilt is just as widespread as cotton wilt.
Illinois	55,000	This was total acreage planted, 1947. Average for 1929-38, planted and affected, 186,800. Soybeans have replaced large part of acreage.
Montana	0	
New Jersey	?	See cabbage.
Oklahoma	22,500	10% of acreage
Rhode Island	0	
Texas	1,000	
Virginia	6,000	

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
FLAX		
Kansas	25%	
Minnesota	1,500,000	Virtually all of the flax area is infested to some degree, but the use of resistant varieties and crop rotation minimizes its economic importance.
South Dakota	456,000	
MUSKMELON		
Michigan	100	
Minnesota	40-50	No drastic change in area affected. Resistant varieties are now grown. Fusarium wilt is common on muskmelons near Minneapolis and St. Paul, but the crop is grown on only a few acres.
New York	---	An area approximately 20 miles wide, along the Great Lakes, extending from Chautauqua County to Sodus Bay in Wayne County. There are several small islands of infection in fields outside of this area, especially in Genesee, Ontario, and Albany Counties. This disease was first observed about 1917.
OATS		
Illinois	3,343,000	100% of planted acreage, 1947. All cultivated land in the State is infested with Fusarium. Average oat acreage 1929-38, 3,885,800
OKRA, PEPPER, ETC.		
Arkansas	100	
ONION		
Connecticut	300	Limited production as food crop.
Illinois		No acreage data available. Acreage very small.
Massachusetts	800	Acreage affected at an earlier time was estimated at 1500. More profitable crops have been substituted.

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Onion cont.)		
Michigan	500	No data, possibly 500.
Montana	0	
New Hampshire	25	
New Jersey	2,000	Traces
New York	---	No real Fusarium trouble on this crop in the State. Certain bulb rots, but this is not primarily a soil problem.
Oklahoma	15	2% of acreage.
Pennsylvania	30	Less than 30 out of the 400 acres of onions in Pennsylvania infected. Loss trace to 5%.
Rhode Island	0	
Texas	0	
PEA		
Connecticut	500	Limits peas to early crop.
Delaware	3,000	All our pea acreage has root rot of one kind or another. 3,000 acres affected in 1938.
Illinois	17,900	This is acreage planted in 1947, 100% affected. All cultivated land in State infested with Fusarium. Average acreage for 1929-38 was 14,800.
Maine		Some found occasionally.
Maryland	5,000	
Massachusetts	500	No change from previous years.
Minnesota	100,000	Common wilt of peas would probably be present in all the canning pea area, but no susceptible varieties are grown. Near-wilt is less common.
Montana	34,000	
New Hampshire	100	No change from previous years.
New Jersey	1,000	
New York	---	True wilt rare in the State. A trace probably in all the intensive pea areas. Near-wilt very common and destructive. Appears in all pea fields where long rotations are not practiced. Probably much more general than it was 30 years ago.

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Pea cont.)		
Oklahoma	25	5% of acreage
Pennsylvania	2,000 to 3,000	17,500 acres of peas grown in Pennsylvania. Trace to 0.5% loss.
Rhode Island	0	
South Dakota		All garden areas affected.
Texas	0	
Virginia	2,000	
West Virginia	10	
Wisconsin	20,000	Resistant varieties have reduced the acreage from 80,000.
Wyoming	Trace	
POTATO		
Arkansas	Trace	
Connecticut	150	Seasonal, 2,000 acres affected in 1947.
Delaware	100	Acreage affected at an earlier time unknown. Constant cropping increases loss.
Illinois	11,000	Estimated planted acreage 1948. Average for 1929-38 was 46,900. Economic factors, e. g., change in marketing, etc., caused decrease in planting.
Maine	0	Though probably total acreage (200,000) has tuber rot _Fusaria_ in some amount.
Maryland	5,000	
Massachusetts	100	No change from previous years. Use of resistant varieties.
Michigan	Local	No data on total area. Scattered local infestations.
Minnesota	Trace	Of no economic importance.
Montana	17,000	
New Jersey	25,000	Slightly more than 10 years ago. Undoubtedly present in large percentage of acreage but seldom cause of readily detected economic loss.
New York	Trace	Seems less common than it did 30 years ago. A trace is found in same area as cabbage _Fusarium_ wilt.
North Dakota	1,300	Improved seed. 2,000 acres affected in 1930.

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Potato cont.)		
Oklahoma	1,300	5% of acreage
Pennsylvania	Trace	
Rhode Island	2,000	The weather conditions in 1948 made this disease our worst for potatoes, cut yields in some fields 50%
South Dakota	40,000	
Texas	Trace	
Virginia	10,000	
West Virginia	2,100	
Wisconsin	Trace	
Wyoming	600	100 acres now out of potato production because of severity of *Fusarium* under dry land conditions.
RYE		
Illinois	57,000	All of cultivated land in the State is infested with *Fusarium*. This is acreage planted in 1947. Average for 1929-38 was 85,700.
SPINACH		
Connecticut	0	
Illinois	---	No acreage data available. Acreage very small.
Maryland	200	
Montana	0	
New Jersey	100	See cabbage
New York	200	*Fusarium* wilt is present in about 200 acres in Nassau County on Long Island. This area probably was infested within the past 20 years.
Oklahoma	150	5%
Pennsylvania		Some likely.
Rhode Island	0	
Texas	0	
TOBACCO		
Kentucky	---	About 1/5 of the farmers who attended the 1948 field meetings at Lexington recognized *Fusarium* wilt of tobacco as a disease they had seen in their own plantings.

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
SWEET CLOVER AND RED CLOVER		
Illinois	1,500,000	Estimated acreage of land planted in red clover; no data available. All cultivated land in the State is infested with *Fusarium*.
South Dakota	20,000	Only sweet clover mentioned.
Texas	2,000	Sweet and red clover.
SWEETPOTATO		
Arkansas	2,600	Use of certified slips has reduced the acreage affected from 5,000.
Delaware	1,000	Earlier affected acreage 3,000--decrease in acreage of crop.
Georgia	Widespread	In most cultivated fields of South Georgia and also widespread in North Georgia, but there is rarely much of it in any one field.
Illinois	2,200	All of land planted; 2,200 acres in 1947, 6,100 acres average 1929-38.
Kansas	50%	The stem rot fungus (*F. batatatis*) is present in over 50% of ground used in Kansas for this crop but the disease has, during past few years, not caused much loss. The decreased loss is due partly because new land is used when available and to a large degree because of the practice of treating the sprouts which protect the plants against post-planting losses that occur through infection at the wounded ends. Such fungicides as Spergon protect against such infection until the wound is healed.
Kentucky		Common in Louisville area.
Maryland	8,500	
Montana	0	
New Jersey	10,000	Less damage than 10 years ago. Better cultural practices have reduced percentage of infection in infested soils. Some of the

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Sweetpotato cont.)		
New Jersey (cont.)		*Fusarium* problems of sweetpotato are acute in specific areas where poor crop rotations are used. *Fusarium* infestations are very widely distributed but only traces of injury result until the population is built up through continuous cropping with a susceptible crop. Dr. Daines reports that "approximately 4% of sweetpotato acreage is lost due to *Fusarium* but practically all the acreage is slightly infested."
New York		Crop almost never grown. One instance of *Fusarium* wilt found on Long Island.
Oklahoma	500	5% of acreage
Pennsylvania	Trace	Trace-1% loss.
Texas	100	
Virginia	15,000	
TOMATO		
Alabama	2,000	Total tomato acreage in State estimated at 13,000.
Arkansas	15,000	2,000 acres severe.
Connecticut		Rare
Delaware	1,000	No basis for earlier estimate. Constant cropping increased loss.
Georgia		Found in every old garden and out in in the fields of a few counties in southeast Georgia that have been growing commercial tomatoes.
Illinois	4,000	Acreage planted 1947, 15,800; estimated acreage with disease, 4,000. Corresponding average for 1929-38, 11,800 and 2,000.
Kansas	50%	In recent years losses small, wilt resistant varieties used.
Kentucky		*Fusarium* wilt develops where tomatoes are grown in the same soil, nearly anywhere in the State except that it is rare in the central blue grass area.

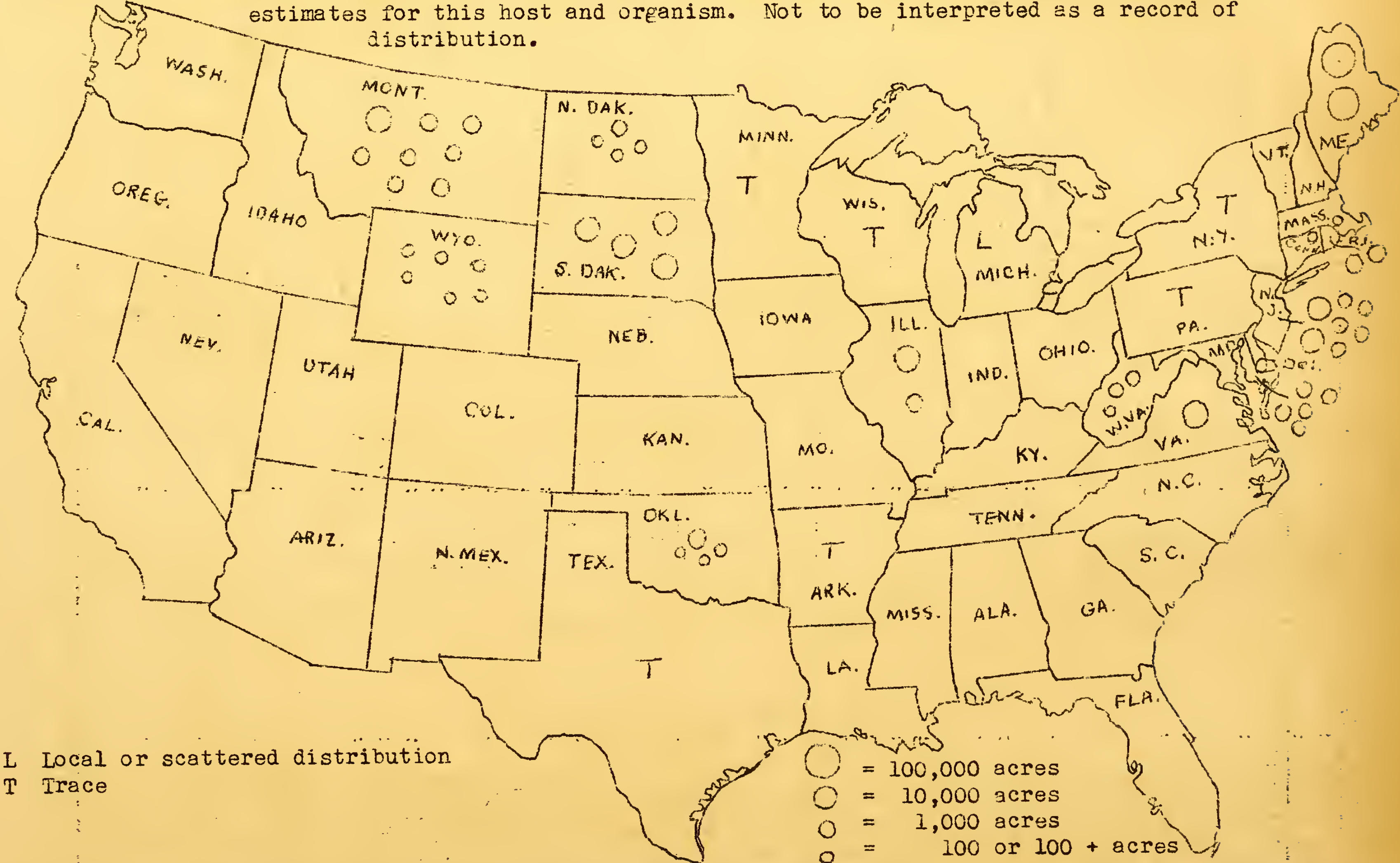
Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Tomato cont.)		
Maryland	40,000	
Massachusetts	200	Use of resistant varieties has reduced the affected acreage from 500.
Michigan	Local	Scattered local infestations. Resistant varieties now grown in infested areas.
Minnesota	0	
Montana		Present; it is of no economic importance.
Nevada		Occurs in home gardens.
New Jersey	1,000	See cabbage.
New York	---	About one-half the tomato acreage on Long Island, and a few fields in Chautauqua County. Rarely individual wilted plants are found in the area bordering Ontario and Erie Lakes. This area apparently has not changed, at least since 1912.
Oklahoma	300	10%
Pennsylvania	Trace	In field less than 400 infected acres out of 40,000 grown. In greenhouse over 10% of bed area.
Rhode Island	Trace	
Texas	50,000	
Virginia	25,000	
West Virginia	300	
Wisconsin	Trace	
Wyoming	Trace	Few tomatoes grown.
WATERMELON		
Alabama	5,000	Watermelons are moved to new land as fast as wilt appears. The infested acreage is thus on the increase each year.
Arkansas	420	
Georgia	---	Watermelon wilt has been found widespread in south Georgia but not as widely scattered in north Georgia.
Illinois	2,000	Estimated acreage planted 1948, 2,600; estimated acreage with disease, 2,000. Corresponding acreages, average 1929-38, 5,000 planted, 5,000 affected. Fusarium

Table 1. (Fusarium acreage) continued.

State reporting	Acreage affected	Remarks
(Watermelon cont.)		
Illinois (cont.)		wilt mainly responsible for decreased acreage. Some acres have almost abandoned watermelons.
Kansas	Trace	Kansas has not had much trouble lately with watermelon wilt (*Fusarium niveum*) probably because this crop is usually grown only at long intervals on the same ground. Wilt has been known in past to be very serious in certain fields and growers no longer grow watermelons in such fields. Of the land that has been planted to watermelons in Kansas, an estimated 25% is infested with the wilt organism.
Kentucky	---	Watermelons fail in the sandy soil along the Ohio River in the vicinity of Cincinnati and east and west.
Maryland	2,500	
Minnesota	Trace	
New Jersey	50	See cabbage.
New York	Trace	A trace observed on Long Island.
Oklahoma	2,000	10%
Pennsylvania	5	Loss 3% in 1938-39. Not recorded in other years.
Rhode Island	0	
South Dakota	2,000	
Texas	20,000	
Virginia	1,500	
West Virginia	100	
Wisconsin	50	None found previously. Susceptible varieties have built up fungus.
GENERAL		
Illinois		All cultivated land in the State is infested with *Fusarium*.
New Jersey		See cabbage.
Rhode Island		All cultivated soils in the State are infested. We have no concept of the damage done.

Figure 1. Estimated potential acreage, in States reporting, infestested with *Fusarium* pathogenic to potato. These figures are estimates only, based on best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this host and organism. Not to be interpreted as a record of distribution.



L Local or scattered distribution
T Trace

Figure 2. Estimated potential acreage, in States reporting, infested with Fusarium pathogenic to tomato. These figures are estimates only, based on best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this host and organism. Not to be interpreted as a record of distribution.

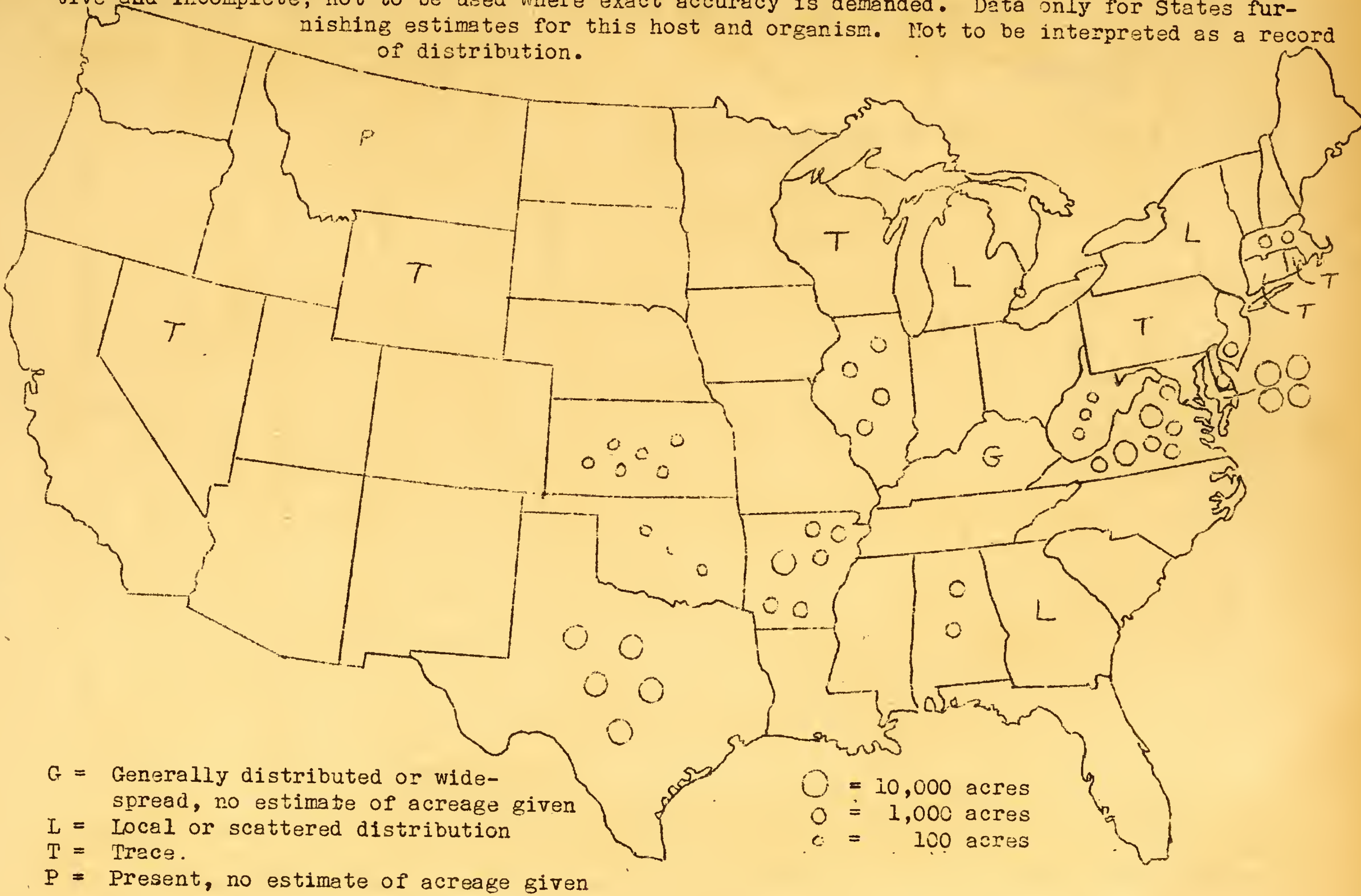


Figure 3. Estimated potential acreage, in States reporting, infested with _Fusarium_ pathogenic to watermelon. These figures are estimates only, based on best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this host and organism. Not to be interpreted as a record of distribution.

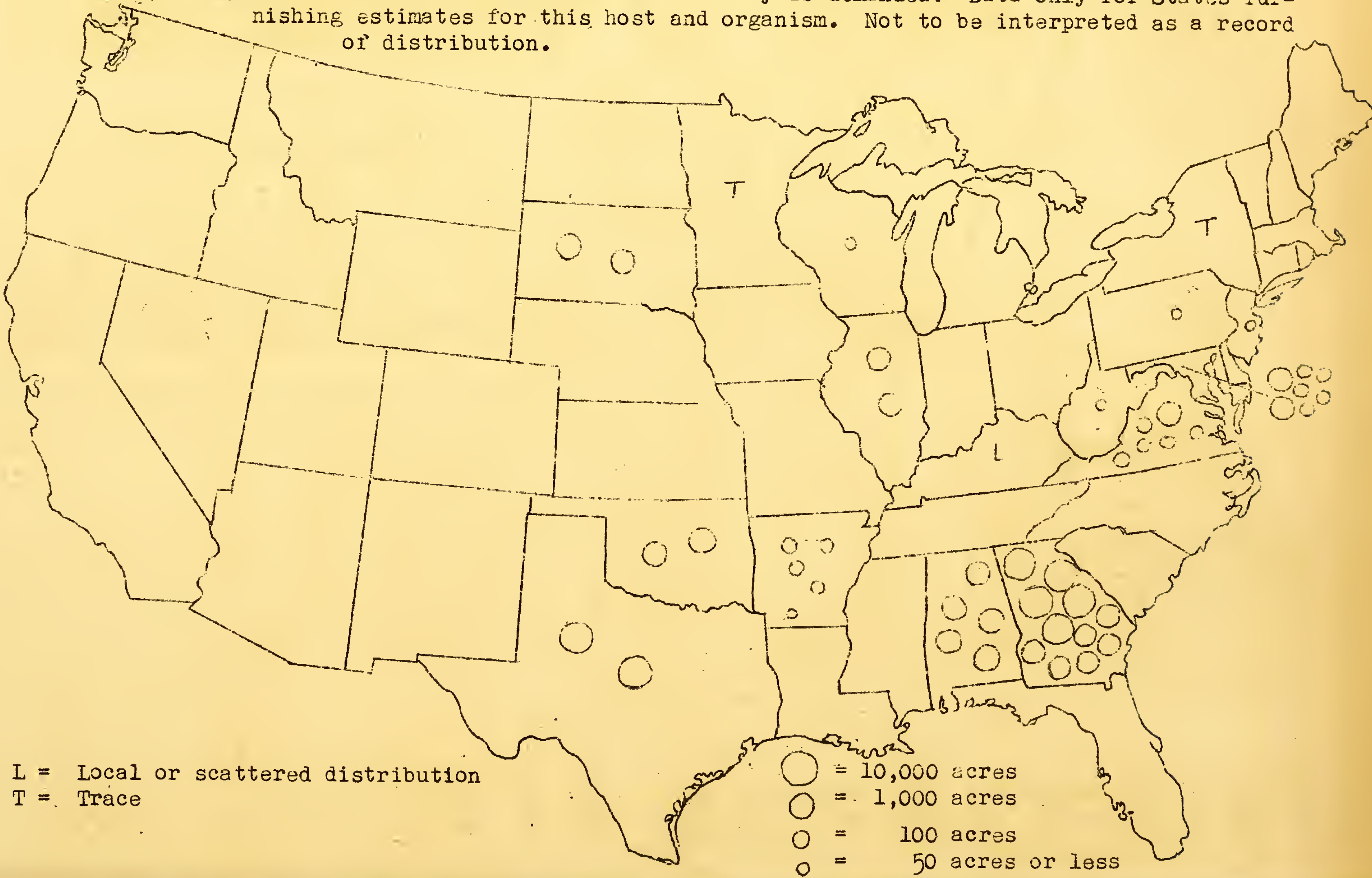


Table 2. Estimated potential acreage of crop land infested with Rhizoctonia, mostly R. solani, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
GENERAL		
Arkansas		Rhizoctonia no doubt present almost everywhere.
Georgia		Not believed to be widespread. Found chiefly in old gardens and in all mountain valleys where potatoes are grown.
Illinois		Rhizoctonia occurs in all cultivated soils of the State.
Kentucky		Probably in all crop lands of State but recognized only occasionally, on potatoes, tobacco, and as common cause of damping-off.
Minnesota		Can be found on practically all plants in all parts of State if looked for.
New Jersey		Probably universally present in our field soils and on susceptible crops may cause noticeable injury to a few plants or to the crop as a whole under very special conditions. Losses are sometimes serious in plant beds under glass but acreage here is low. Soil treatment specifically for Rhizoctonia would not be warranted except in plant beds and greenhouses.
New York		Present in all soils in the State, and on every cultivated and weed host. It becomes severe only when certain weather conditions (the correct combination not fully understood) are present, and crops are grown without rotation.

Table 2. (Rhizoctonia acreage) continued.

State reporting	Acreage affected	Remarks
ALFALFA		
Arkansas	Trace	
Illinois	521,000	Acreage planted in 1947, 521,000; average for 1934-43 was 477,000. R. crocorum occurs probably in all soils of the State, although occasionally found on alfalfa, it is not an important pathogen.
Kansas	0.1%	R. crocorum
Massachusetts	800	No change in acreage noted from previo years.
New Jersey	General	
Oklahoma	300,000	
Pennsylvania	---	316,951 acres of alfalfa, but acreage affected unknown.
South Dakota	381,000	Alfalfa and Timothy
Texas	0	
Virginia	10,000	
BEAN		
Illinois	1,700	Estimated acreage for 1948. Average for 1929-38 was 1,570. Rhizoctonia occurs in all cultivated soils of the State.
Maine		Some found occasionally.
Texas	1,000	
Wyoming	500	
CABBAGE		
Illinois	3,000	Estimated acreage planted for 1948. Average for 1929-38 was 2,335. Only affects seedlings. See general
Massachusetts	1,000	No change in acreage noted from previo years.
New Hampshire		Greenhouse problem only
New Jersey		Greenhouses only
Oklahoma	100	
Pennsylvania	5,000	Loss 1 to 2%. Likely present in 5,000 of the 10,977 acres grown in Pennsylvania.
Texas	100	
Virginia	3,000	
CEREALS		
Arkansas	Present	
New Jersey	Trace	
North Dakota	50,000	
Oklahoma	1,000,000	

Table 2. (Rhizoctonia acreage) continued.

State reporting	Acreage affected	Remarks
(Cereals cont.)		
Pennsylvania	Trace	Wheat 903,442 acres; oats 817,142 acres; barley 100,531 acres in the State.
Wisconsin	Trace	
COTTON		
Alabama	500,000	
Arkansas	200,000	Probably present in 2,000,000 acres but generally slight damage.
Illinois	4,000	Acreage planted in 1947, 4,000. Average 1934-43, 4,500. See general.
Oklahoma	1,500,000	
Texas	5,000,000	
Virginia	20,000	
COWPEA		
Oklahoma	200,000	
Texas	5,000	
FLAX		
Minnesota		Of minor importance on flax. See general.
GRASSES		
Minnesota		Of minor importance on grasses. See general.
LADINO CLOVER		
Wisconsin	200	New crop
LETTUCE		
Massachusetts	2,000	Same as previously
LEGUMES		
Oklahoma	8,000	See also soybean and cowpea.
PEANUTS		
Oklahoma	70,000	
Texas	1,000	
PEAS		
Illinois	17,900	See general. 17,900 acres planted in 1947; average 14,800 acres for 1929-38.
Maine		Some found occasionally.

Table 2. (Rhizoctonia acreage) continued.

State reporting	Acreage affected	Remarks
(Peas cont.)		
Maryland	5,000	
Massachusetts	1,000	Same as other years.
Montana	34,000	
North Dakota		7,000 acres in peas; no data as to acreage affected.
New Jersey	Scattered	See general.
Oklahoma	500	
Pennsylvania	5,800	Loss 1/2 to 1%. Scattered infection in at least 1/3 of Pennsylvania's 17,500 acres.
Virginia	1,000	
Wisconsin	Trace	
Wyoming	Slight	
POTATO		
Alabama	45,000	No serious loss.
Arkansas	42,000	Damage slight.
Connecticut	2,000	
Delaware	1,000	Always has been infected since crop was grown.
Georgia	Local	Chiefly in mountain counties and valley[s] and in gardens or where truck has bee[n] grown. Not widespread.
Illinois	11,000	Estimated acreage for 1948. Average for 1929-38, 46,900. R. solani occur[s] probably in all soils of the State.
Kentucky	---	See general.
Maine	200,000	Estimated by chief certification inspector. Maximum infection = 75% of missing hills.
Maryland	25,000	
Massachusetts	22,000	15,000 acres affected in 1940. Increase in potato culture increased affected acreage.
Montana	17,000	
Nevada		Occurs but affected acreage is not known
New Hampshire	10,000 to 2,500	All land in State where potatoes are grown; varies from 10,000 to 2,500 acres.
New Jersey		Probably slightly less than 10 years ago. See general.
New York	---	See general.
North Dakota	2,500	135,000 acres planted.
Oklahoma	25,000	
Pennsylvania	106,000	Most soil infested. 1946-47 loss 7.5%, 1937-45, 2.5%. Wet springs 1946-47. Some in all of 106,000 acres of potatoes in Pennsylvania in 1948.

Table 2. (Rhizoctonia acreage) continued.

State reporting	Acreage affected	Remarks
(Potato cont.)		
Rhode Island	8,000	Annually. Injury varies with edaphic factors during growing season.
South Dakota	40,000	
Texas	1,000	
Virginia	10,000	
West Virginia	42,000	Light infection mostly--not much change through year.
Wisconsin	86,000	196,000 affected previously. Different cropping practices used.
Wyoming	500	Not a major trouble---potatoes planted late.
SOYBEAN		
Minnesota		Of minor importance on soybeans. See general.
Oklahoma	10,000	
STRAWBERRY		
Arkansas		Present, severe only locally.
Illinois	3,000	Estimated acreage for 1948. Average for 1929-38, 5,100. Many growers had larger acreages than they could care for profitably.
Maryland	100	
Massachusetts	300	500 acres in 1940. High cost of production in recent years has decreased acreage grown.
New Hampshire	100	
New Jersey		Common in roots. See general.
Oklahoma	100	
Texas	0	
Virginia	3,000	
Wyoming	---	Slight
SWEET CLOVER		
Minnesota	---	Is of minor importance on sweet clover. See general.
South Dakota	20,000	
TOBACCO		
Kentucky	---	See general.
Virginia	50,000	
TOMATO		
Texas	20,000	

Figure 4. Estimated potential acreage, in States reporting, infested with <u>Rhizoctonia</u> pathogenic to potato. These figures are estimates only, based on best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this host and organism. Not to be interpreted as a record of distribution.

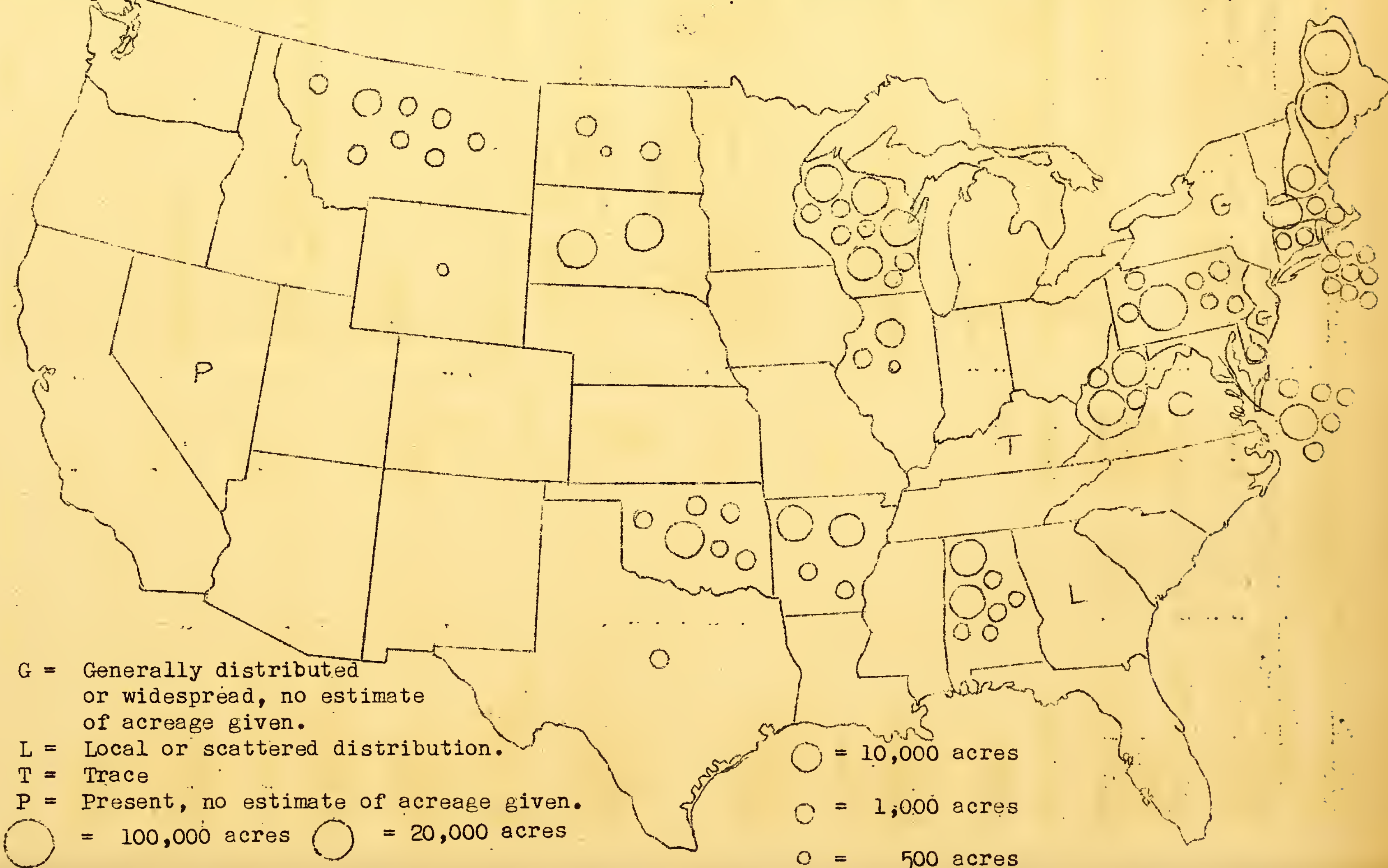


Table 3. Estimated potential acreage of crop land infested with Sclerotinia sclerotiorum, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
GENERAL		
Alabama		Found occasionally but no records of any appreciable loss on any crop from this fungus.
Arkansas		Seldom seen except in traces.
Georgia		Very rare according to observations.
Illinois		This fungus is probably present in most of our soils but, as far as we know, has not caused any appreciable loss in any of the crops.
Kentucky		Would expect this fungus, because of the method of spore production, to be found anywhere. Actual damage from the fungus is probably very limited.
Maryland		No estimate possible.
Minnesota		Practically no economic importance.
New Hampshire		May be present, but not seen on other hosts than bean.
New Jersey		Observations in table below apply to field cultures. In plant beds and in North Jersey where many acres of vegetables are grown under glass, Sclerotinia often causes such serious losses that soil sterilization is called for.
New York		This organism is present in all soils where cabbage, carrots, and celery are grown continuously, or where such crops as beans, clover, and parsley are grown in especially thick stands. It always is present in certain greenhouse soils. When resistant crops as cereals, grasses, potatoes, beets, corn, onions, etc., are grown for several years, the inoculum disappears until a series of susceptible crops again are grown. It has always been State-wide.

Table 3. (Sclerotinia acreage) continued.

State reporting	Acreage affected	Remarks
(General cont.)		
Rhode Island		Drought in August-September caused absence of disease in 1948, but when rainfall is abundant this fungus causes conderable damage. Chief losses in common storage.
Texas		Probably 500 acres for various hosts, and 500 where tomatoes are grown.
West Virginia		Not serious.
Wisconsin		Rarely found.
ALFALFA		
Georgia		In mountain counties.
South Dakota	381,000	
BEANS		
Delaware	0	
Massachusetts	500	No change in affected acreage through years.
Montana	1,000	
New Hampshire	10	
New Jersey	Trace	See general.
New York		See general.
Pennsylvania	Trace to 1%	Only a trace infection in 4,800 acres of snap beans.
Rhode Island	0	10 acres potentially affected. Drought August-September in 1948 caused absence of disease. See general.
Virginia	6,000	
West Virginia	Trace	
Wyoming	500	Increase from 250 acres previously. Continued cropping caused gradual spread in soil.
CABBAGE		
Delaware	0	
Georgia	---	Not widespread. Found near Athens.
Massachusetts	600	No change in affected acreage.
Montana	None	
New Jersey	---	Occasional plants. See general.
New York	---	See general.
Pennsylvania	Trace to 1%	
Rhode Island	0	10 acres potentially affected. None in 1948. See general.

Table 3. (Sclerotinia acreage) continued.

State reporting	Acreage affected	Remarks
CARROT		
Delaware	None	
Massachusetts	2,000	
Montana	None	
New Jersey	---	Occasional plants. See general.
New York	---	See general.
Pennsylvania		Records show trace to 2% loss.
Rhode Island	0	10 acres potentially affected. See general.
CELERY		
Connecticut	50	
Delaware	0	
Massachusetts	---	Of little importance on this host.
Montana	0	
New Jersey	---	Occasional plant. See general.
New York	---	See general.
Pennsylvania	250	Loss 1 to 10%; 250 acres infested out of 550 in Pennsylvania. Losses higher previously; storing at lower temperature has reduced them.
Rhode Island	0	None in 1948. See general. 5 acres of celery land potentially infested.
RED CLOVER		
Georgia	---	Found in mountain counties on clover.
New Jersey	100	About 100 acres of red clover fields severely infected have been recorded. See general.
New York	---	See general.
LETTUCE		
Georgia	Not widespread	See general. Coastal Counties chiefly. Records on lettuce near Athens and in Glynn County and on the Islands off Brunswick.
Kentucky	---	Have seen it on lettuce in the Lexington area.
Minnesota	---	Occasionally destructive on head lettuce on a few acres in Northern Minnesota.
New Jersey	200	See general. About 200 acres of lettuce soil severely infested have been recorded.

Table 3. (Sclerotinia acreage) continued.

State reporting	Acreage affected	Remarks
PARSLEY		
New York	---	See general.
PEAS		
Delaware	0	
Massachusetts		Of little importance on this host.
Montana	0	
New Jersey		Not observed.
Pennsylvania	0	No infection in the 17,500 acres of peas in Pennsylvania.
Texas	Trace	
Virginia	2,000	
Wyoming	Trace	
POTATO		
Maine	---	Some found occasionally.
STRAWBERRY		
Delaware	0	
Illinois	---	Very little. See general.
Massachusetts	---	Of little importance on this host.
Montana	0	
New Jersey		Not observed on strawberry. See general.
Pennsylvania	0	No infection in 2,200 acres in Pennsylvania.
Virginia	3,000	
SUNFLOWER		
Minnesota	---	Has been found on sunflower, but is of practically no economic importance.
North Dakota	500	Increased from traces earlier because sunflowers grown more extensively.
SWEET CLOVER		
South Dakota	20,000	
TOMATO		
Delaware	0	
Illinois		See general.
Massachusetts		Of little importance on this host.
Montana	0	
New Jersey	Trace	See general.
Oklahoma	Very minor	

Table 3. (Sclerotinia acreage) continued.

State reporting	Acreage affected	Remarks
(Tomato cont.)		
Pennsylvania	10	Only a trace; less than 10 acres out of 40,000 grown in Pennsylvania.
Texas	500	
West Virginia	Trace	Not a serious pest in this State.
Wisconsin	Trace	Rarely found in this State.

Table 4. Estimated potential acreage of crop land infested with Verticillium, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be intrepreted as a record of distribution.

State reporting	Acreage affected	Remarks
GENERAL		
Arkansas		We believe that Verticillium is generally present in most Arkansas soils. We have found isolated infections on several hosts. Incidence varies tremendously with the season.
Illinois		All cultivated acreage in the State infested.
Minnesota		Can be found on potato, eggplant, and tomato but does not seem to be of economic importance.
Montana		No information available.
New Jersey		Indications are that fungus is very widely distributed but no evidence that it is causing appreciable injury to any crop except eggplant. See eggplant.
New York		So far as is known all soils in New York State contain Verticillium. Apparently, however, the strains are relatively dormant until certain crops are grown repeatedly in the same soil. Most crops are not affected unless the soil is saturated continually with water for a number of days. This is true especially of crops like potatoes and tomatoes. But black raspberries and eggplant, which are very susceptible, become infected even in moderately dry soil. Occurs on nearly every cultivated and weed plant known.

Table 4. (Verticillium acreage) continued.

State reporting	Acreage affected	Remarks
(General cont.)		
Texas		Not a factor in crop production, except in the case of cotton.
Wyoming		As far as known, no soil infestation with Verticillium.
CHRYSANTHEMUM		
New Jersey	Trace	See eggplant.
New York	---	See general.
COTTON		
Alabama	500	
Arkansas	159,335	Great fluctuation due to weather. We believe that Verticillium is present in most Arkansas soils. We have had it affect cotton in northwest Arkansas soil never before in cotton. The estimate is based on 25% of the soils of the Mississippi Delta in Arkansas which are devoted to cotton -- 637,840 acres in 1946 in counties touching the Mississippi. 25% of this area will have some visible indication of Verticillium wilt on the average. The area where the disease is really serious would be much less.
Georgia	Trace	Recent introduction; discovered near Griffin and probably only place where it occurs at present.
Illinois	4,000	4,000 acres planted in 1947; 4,500 average for 1934-43. All cultivated soils infested.
Oklahoma	8,000	0.5%
Texas	15,000	
EGGPLANT		
Alabama		Not reported on this plant in Alabama.
Arkansas		No data.
Connecticut	10	100%
Illinois	---	No acreage data available.
Kentucky	---	There has been some Verticillium trouble on eggplant in the Louisville vegetable growing area.
Massachusetts	200	
Michigan		No record.

Table 4. (Verticillium acreage) continued.

State reporting	Acreage affected	Remarks
(Eggplant cont.)		
Minnesota	Trace	Can be found on eggplant but does not seem to be of economic importance.
New Hampshire	10	Some Verticillium has been found on eggplant. Eggplant is grown only in home gardens in the southern part of the State, thus the number of infested areas may be many but the total average small.
New Jersey	800	Verticillium on potatoes and tomatoes can be found in many plants by tissue culturing, indicating that the organism is very widely distributed but we have no evidence that Verticillium is causing appreciable injury on any crop except eggplant. Verticillium on eggplant is a major problem and we believe that approximately half of our 1700 acres of eggplant land is fairly heavily infested. Verticillium is so universally present as a soil fungus that we would probably have to admit that 100% of our soil is very lightly infested but only under certain cropping systems does the fungus cause any economic losses. Okra and eggplant finally become infected almost anywhere that these crops are planted year after year on the same farm.
New York	---	See general.
Pennsylvania	60%	Nearly all acreage having eggplants the previous year and half of the acreage for first year.
Rhode Island	---	None seen this season; 5 acres affected at other times. Small acreage grown.
West Virginia	Trace	
ELM		
Arkansas		Seen on elm.

Table 4. (Verticillium acreage) continued.

State reporting	Acreage affected	Remarks
FLOWERING PEACH		
Arkansas		Seen on flowering peach.
OKRA		
New Jersey	Present	Okra and eggplants finally become infected almost anywhere that these crops are planted year after year on the same farm. See eggplant.
PEACH		
New Jersey	Trace	See eggplant.
New York		See general.
PEPPER		
Illinois	700	700 acres planted in 1947; 684 in 1942. All cultivated acreage infested. Increasing in severity on pepper.
New York	---	See general.
PEPPERMINT AND SPEARMINT		
Michigan	10,000 to 20,000	Including abandoned sites. Unrestricted exchange of planting stock from infested soil has spread it.
POTATO		
Alabama		Not reported on this host.
Arkansas		No data. See general.
Connecticut	0	
Illinois	11,000	11,000 estimated planted in 1948; average for 1929-38 was 46,900. Economic factors, e.g., change in marketing, etc. caused decreased acreage. See general.
Maine	20,000	Estimate by chief certification inspector. Maximum for one field, 35% dead plants.
Massachusetts	1,000	
Michigan	50	Severely affected. Scattered lightly affected areas previously observed.
Minnesota	Trace	Can be found on potato but does not seem to be of economic importance.
Nevada	---	Occurs but affected acreage is not known.

Table 4. (Verticillium acreage) continued.

State reporting	Acreage affected	Remarks
(Potato cont.)		
New Jersey	Present	See eggplant.
New York	---	See general.
Pennsylvania	Trace	Only report we have, a trace in 1923.
Rhode Island	Trace	
Texas	---	Disease not a factor in crop production except cotton.
West Virginia	0	
Wisconsin	Trace	Very minor.
PRIVET AND FLOWERS		
Massachusetts	25	
RASPBERRY		
Alabama		Not reported on this plant in Alabama.
Arkansas		No data.
Illinois	---	No acreage data available. Very little on raspberry.
Maryland	100	
Massachusetts	75	
Michigan	---	No records but present since specimens are received each season. No survey has been made.
New Jersey	Trace	See eggplant.
New York	---	See general.
North Dakota	100	
Pennsylvania	200	10%. In 200 acres out of 2,474 acres of raspberries in Pennsylvania.
Rhode Island	0	
SNAPDRAGON		
Michigan		Occasionally reported in garden plantings.
TOMATO		
Alabama		Not reported on this plant in Alabama.
Arkansas		No data.
Connecticut	0	
Delaware	500	Seems to be on increase due to constant cropping.
Illinois	15,800	Acreage planted in 1947. Average for 1936-45, 14,010. See general. No acreage changes in last 10 years.

Table 4. (Verticillium acreage) continued.

State reporting	Acreage affected	Remarks
(Tomato cont.)		
Massachusetts	300	
Michigan		No record.
Minnesota	Trace	Can be found on tomato but does not seem to be of economic importance.
Nevada	---	Occurs in home gardens.
New Jersey	Present	See eggplant.
New York	---	See general.
Pennsylvania	Trace	Almost none in field, mostly in greenhouse.
Rhode Island	---	None observed this year; 50 acres affected at other times. Depends on weather conditions. Severe some years.
Texas	---	Disease not a factor in crop production, except in case of cotton.
West Virginia	Trace	
Wisconsin	Trace	Very minor.
MAPLE TREES		
Rhode Island		Scattered but prevalent.

Table 5. Estimated potential acreage of crop land infested with *Phymatotrichum omnivorum*, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
GENERAL		
Arkansas	---	Almost absent from the State but is often present in small spots in Red River and Little River soils in Little River, Miller, and Lafayette Counties. We consider it distinctly minor. Less than 435 acres of cotton land affected; 100 acres estimated for alfalfa.
Nevada	5,000	
Oklahoma	600,000	2% of farm land.
Texas	1,300,000	

Table 6. Estimated potential acreage of crop land infested with Heterodera marioni, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
GENERAL		
Alabama	450,000	
Arkansas	863,500	15% of total cultivated acreage. Percentage of cultivated soil affected was formerly less, because much clayey hill land not subject to root knot is now taken out of cultivation and in pasture.
Connecticut	---	Not common.
Georgia	---	Found in practically every garden and is widespread in fields in South Georgia and in most of the lighter soils of North Georgia.
Illinois	---	No data available.
Kansas	---	No data available. Occurs in south central and southeastern Kansas.
Kentucky	---	There are scattered small plots that are infested as the result of importations of tomato and cabbage plants from the South or use of plants from infested greenhouses. Total acreage is very small.
Maryland	10,000	
Minnesota	0	
Nevada	---	Generally distributed throughout State.
New Hampshire		Greenhouse problem only.
New Jersey		I believe it is Dr. Steiner's opinion that this nematode is universally present in New Jersey soils in slight traces. My estimates below are based on acreage that is sufficiently heavily infested to cause noticeable injury.

Table 6. (Heterodera acreage) continued.

State reporting	Acreage affected	Remarks
(General cont.)		
New Jersey (cont.)		It causes appreciable damage in plant beds and to greenhouse vegetables and ornamentals.
New York	400	Vegetable fields on upland.
	600	Vegetable fields on muckland. Is indigenous on weeds in this State. It is held down by rotating or fumigation, but doubtless is increasing. Is reduced by cold open winters and increases after mild snowy ones.
	50	Or 75% of vegetable greenhouse area.
	50	Or 15% of floral greenhouse area. Gradually on the increase in greenhouses as it is never eradicated; only held down by steaming, fumigating, rotating, and changing soil.
North Dakota	---	No records on this. Probably more important than we suspect.
Oklahoma	200,000	10% of crop land.
Rhode Island	5	Almost all greenhouses growing tomatoes, cucumbers, gardenias, and other warm temperature crops are infested. Many greenhouses have failed or changed their crops because of this pest. None found in field soils.
Texas	10,000,000	
Virginia	---	Estimate 10,000 acres in home vegetable gardens. See also tomato, tobacco. General on ornamental and vegetable seedlings in greenhouses.
West Virginia	---	Primarily of importance in gardens in southern west Virginia, in Raleigh, Fayette, Mercer, Logan, Lincoln, Boone, McDowell Counties. Approximately 5% of the gardens are affected; no accurate data on total acreage.
Wisconsin	---	Not found in field. Traces in old greenhouses in Milwaukee area. Tomato main crop affected.

Table 6. (Heterodera acreage) continued.

State reporting	Acreage affected	Remarks
CARROT		
Massachusetts	50	In small areas near commerical vegetable and ornamental greenhouses.
Michigan	250-500	
New Jersey	---	Occasional. See general.
Pennsylvania	---	Some.
CELERY		
Michigan	500	
New Jersey	---	In muck. See general.
Pennsylvania		Some.
CUCURBITS		
Delaware	200	Seems to be on increase.
Rhode Island	---	Greenhouses. See general.
GARDENIA		
Rhode Island		See general.
HORSERADISH		
New Jersey	---	Occasional. See general.
LIMA BEANS		
Delaware	100	Seems to be of recent appearance.
New Jersey	1,000	Appreciable damage on possibly 1,000 acres in Cape May County. See general.
ONION		
Michigan	500-750	
PARSNIPS		
New Jersey		Occasional. See general.
PEANUT		
Georgia	---	Last summer and this summer (1948) we have had what is apparently a new strain on peanuts in two or three southern counties. See general.
PEONY		
Michigan	250	

Table 6. (Heterodera acreage) continued.

State reporting	Acreage affected	Remarks
PEPPER		
New Jersey	---	Occasional. See general.
POTATO		
Maine	---	Some found rarely by Nematode Survey.
SPINACH		
New Jersey	---	In muck. See general.
STRAWBERRY		
Delaware	500	Has appeared recently since strawberries are grown on sandy soils.
Michigan	300	
SUGAR BEETS		
Montana		Present in a few fields.
TOBACCO		
Massachusetts	---	Undetermined amount of tobacco land infestation in southern towns.
Virginia	5,000	
TOMATO		
New Jersey	---	Few fields. See general.
Pennsylvania	---	Some.
Rhode Island		Greenhouse. See general.
Virginia	10,000	
Wisconsin	---	Traces in old greenhouses in Milwaukee area. Tomato main crop affected.

Table 7. Estimated potential acreage of crop land infested with nematodes other than the root-knot nematode, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
ALFALFA STEM NEMATODE (*Ditylenchus dipsaci*)		
Nevada	10,000	
ONION BULB NEMATODE (*Ditylenchus putrefaciens*)		
New York	500	None in 1930. One crop system with no or inadequate rotation responsible for spread.
SUGAR BEET NEMATODE (*Heterodera schachtii*)		
Wyoming	50	
MEADOW NEMATODE (*Pratylenchus pratensis*)		
Maryland	---	Known to be widely distributed on ornamentals but no acreage estimate possible.
Virginia	1,000,000	

Table 8. Estimated potential acreage of crop land infested with other organisms, in States reporting. These figures are estimates only, based on the best available information, but mostly tentative and incomplete; not to be used where exact accuracy is demanded. Data only for States furnishing estimates for this organism and the host named; from other States no estimate received. Not to be interpreted as a record of distribution.

State reporting	Acreage affected	Remarks
<u>Actinomyces</u> <u>ipomoea</u>		
SWEET POTATO		
Kansas	50%	Estimated 50% of land used for sweet-potatoes in Kansas is infested with the soil pox organism. Severity of infection varies from mere presence to amount because of which growers no longer risk planting in those fields. Much otherwise good sweetpotato land in Kansas is no longer used for sweetpotatoes because of soil pox infestation.
<u>Bacterium</u> <u>solanacearum</u>		
TOBACCO		
Virginia	2,000	
TOMATO		
Virginia	500	
<u>Corynebacterium</u> <u>insidiosum</u>		
ALFALFA		
Kansas	80%	Based on the 1948 crop. However, since alfalfa wilt remains alive in the soil for several years, it is possible that the land infested with this bacterium would be double or triple the acreage of the crop grown in 1948.
<u>Diplodia</u> <u>zeae</u>		
CORN		
Kansas	75%	

Table 8. (Other Organisms) continued.

State reporting	Acreage affected	Remarks
Dry land root rot		
WHEAT		
Kansas	30%	
Gibberella zeae		
CORN		
Kansas	5%	Ear and stalk rot.
WHEAT		
Kansas	3%	Scab.
Helminthosporium spp.		
BARLEY		
Wisconsin	50,000	Formerly 10,000 acres estimated; increase due to susceptible varieties.
CEREALS		
Oklahoma	1,000,000	
Helminthosporium victoriae		
OATS		
Kansas	90%	Although this disease did not occur in the State a few years ago, at present 90% of the acreage is infested with this fungus.
Wisconsin	150,000	Did not occur until recently. Victoria hybrids responsible.
Milo disease		
SORGHUM		
Kansas	80%	
Nigrospora spp.		
CORN		
Kansas	20%	Ear and cob rot.
Ophiobolus graminis		
WHEAT		
Kansas	25%	
Phytophthora sp.		
SWEETCLOVER		
Kansas	30%	Phytophthora root rot.

Table 8. (Other Organisms) continued.

State reporting	Acreage affected	Remarks
Phytophthora nicotianae		
TOBACCO		
Virginia	1,000	None prior to 1937; introduced and spread since then.
Sclerotium bataticola		
CORN		
Illinois	8,696,000	State-wide in distribution. Affects chiefly corn, and is of minor importance in the southern third of the State. 8,696,000 acres planted in 1947; average for 1929-38 was 8,949,500 acres of corn.
Kansas	80%	
SORGHUM		
Kansas	80%	
SOYBEAN		
Kansas	60%	
Sclerotium rolfsii		
GENERAL		
Arkansas	---	May cause serious injury in fields of potatoes, peppers, cucurbits, and garden flowers (possibly *S. delphinii* in the latter case). It may also be serious in sweetpotato beds. Causes as much loss as several of the organisms listed. More serious than the *Sclerotinia*.
Sorosporium reilianum		
SORGHUM		
Kansas	2%	

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Division of Mycology and Disease Survey

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UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 186

LOSSES FROM PLANT DISEASES: EFFECTS ON CROP INDUSTRIES AND ON FARM LIFE

Supplement 186 September 15, 1949

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Plant Industry Station Beltsville, Maryland

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Plant Disease Reporter
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CONTENTS

LOSSES FROM PLANT DISEASES:

EFFECTS ON CROP INDUSTRIES AND ON FARM LIFE

Plant Disease Reporter
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INTRODUCTION

Jessie I. Wood and Paul R. Miller

When the late Dr. Neil E. Stevens was in charge of the Plant Disease Survey, he asked collaborators for illustrations of the failure of crop projects due to plant diseases. These were published, in part, in the Plant Disease Reporter (Vol. 18, no.2, pp. 7-16. Mar. 15, 1934).

Dr. Stevens, along with other forward-looking plant pathologists, was concerned lest plant diseases be overlooked, among other more obvious and commonly recognized causes of risk, in the acreage adjustment and land utilization programs just being started at that time. The primary reason for his request was to accumulate "what might be called disease hazard information" (letter, January 11, 1933) as a preliminary step in demonstrating that plant diseases should be taken into account and plant pathologists consulted in planning these programs. In his foreword in the Reporter, he stressed particularly the historical value of such records, their usefulness as a check on the practical significance of experimental findings, and the service they can render in avoiding "extraordinary disease hazards" in establishing new crop projects.

In the fifteen years that have gone by since the original request, many changes have taken place. Agricultural industries have shrunk or expanded, or moved to entirely new regions. New diseases have threatened established crops, and new crops have brought their own difficulties. Control methods have been developed to take care of some of the earlier problems. Accumulated knowledge about plant diseases has enabled pathologists and growers to check many incipient threats. Moreover, a very great advance is just now being made in the development of chemical controls.

Altogether, it seemed desirable to make a similar survey now. Accordingly, we asked our collaborators for information on changes in crop industries caused primarily by plant diseases, revival due to the development of disease control methods, and new disease problems accompanying the establishment of new crops or resulting from the introduction of new diseases. Later, at the suggestion of Dr. A. E. Dimond of the Connecticut Station we added another heading, more applicable to many situations, i. e., "instances where rapid diagnosis, lucky or prophetic research, and efficient distribution of this information have prevented a new disease from assuming serious proportions."

Another aspect of the effects of plant disease losses, i. e., the extent to which they influence the work and lives of individual farm families, was the subject of an inquiry sent to some 425 County Agents throughout the country. Selection of counties was randomized by using a deck of cards, but some additions and substitutions were suggested by collaborators as better suited to the purpose of the study, so that the final list was partly random and partly selective.

The questionnaire included the following topics:

EFFECT OF PLANT DISEASES ON FARM LIFE*

1. Year when loss occurred (or period of years if loss was cumulative for several seasons):
2. Location (State, County, etc.) and size of farm:
3. Size compared with usual for area: Small -- average -- large
4. Was farmer the owner? How long had he operated this farm?
5. Quality of farming: Poor -- average -- good
6. Crop suffering loss and acreage planted to crop on this farm (see also No. 14):
7. Disease causing loss (how was it identified?):
8. Was the disease a common cause of trouble or was it new to the region?
9. Were any attempts made to control it? What were they?
10. Kind and extent of loss** (see also No. 14): (a) Percent of stand destroyed by or abandoned because of this disease. (b) Reduction in yield: Yield expected (bushels or other crop unit). Yield obtained. (c) Loss in storage: Bushels (or other units) stored. Bushels lost from this disease. (d) Other. (e) Loss expressed in money.
11. Effect of loss on farm management (ownership, machinery, crops grown, etc.):
12. Effect of loss on family life (education, standard of living, health, etc.)
13. Did the farmer recover from his loss? If so, how, and how long did it take?
14. Loss, including forced sale, of farm animals attributable to <u>plant</u> disease, as follows (give kind of animal, number owned, and number lost): (see also No. 6)** : (a) From failure of feed crops due to plant disease. (b) From feeding scabby grain. (c) From ergot in pastures.
15. Remarks

*We realize that in many cases cooperators will not be able to furnish all the information asked for; but we should like to have as much as possible.

**We have indicated methods of stating loss so as to make comparisons possible, but the nature of your material may make it necessary for you to use some other way.

Of the 185 replies received only those quoted below gave definite illustrations of more or less permanent effects of plant disease losses on the prospects of individual farm families. Many County Agents stated that in their counties crop diversification kept any one loss from being too important, or intelligent farming made prompt use of scientific findings and thus prevented loss, or disease loss was of minor importance in comparison with other factors. Some County Agents went to considerable trouble to verify their negative reports. We appreciate this particularly. It is drudgery to be definite and thorough in acquiring only negative information.

A second questionnaire, in tabular form, asked for information on farm mortgage foreclosures resulting from losses due to plant disease attacks. Practically all who responded to this questionnaire stated that no such instances had come to their attention. The few illustrations that were cited are combined with the reports below.

Replies to the question on loss of livestock from the effects of plant diseases were so few as to make their compilation not worth while.

Response to both inquiries follows, in two sections: first, the reports from collaborators on the effects of plant disease losses on crop industries; second, the reports from County Agents on the effects of plant disease losses on farm life. The Survey wishes to thank all those who have cooperated in this undertaking.

I. EFFECTS OF LOSSES FROM PLANT DISEASES ON CROP INDUSTRIES

Reports from Collaborators of the Plant Disease Survey

ALABAMA

By Coyt Wilson

Austrian winter peas were introduced to Alabama farmers about 1925-1930 as a winter legume for soil building purposes. Losses from *Ascochyta* blight became so heavy that most farmers have ceased to use them. Vetch is now being used in most areas where Austrian winter peas were grown a few years ago, and practically no Austrian winter pea seed are produced in the State.

Blue lupines became very popular as a winter legume in southern Alabama between 1940 and 1945. Two factors contributed to its popularity. It made rapid growth and could be ploughed under in February so that there was plenty of time to get the summer crop planted. The second reason was that seed could be produced locally. In the early spring of 1947 anthracnose made its appearance and caused heavy losses in lupines being grown for seed. No control methods have been developed and at the present seed production of lupines is declining in the extreme southern part of Alabama. In Baldwin County lupine acreage has decreased sharply, and it appears certain that this crop will not be planted to any extent in the future.

Fusarium wilt of cotton has forced the growers to use wilt resistant varieties.

Helminthosporium blight of oats has caused farmers in southern Alabama to avoid using varieties that come from any Victoria cross.

About 1940 there was considerable interest in barley as a grain crop in Alabama and the acreage increased sharply. Loose smut and *Helminthosporium* blight and root-rot became so serious that our present acreage is less than one-eighth of what it once was.

Concealed damage of runner peanuts became an important disease in Alabama when the new marketing regulations went into effect. Under these regulations the price is determined by the shelling percentage and by the amount of damage present. Thus, a sample with a shelling percentage of 65 percent containing 2 percent damage will bring less than another sample with a shelling percentage of 65 percent containing only 1 percent damage. Under the old system peanuts were sold as No. 1, No. 2., or No. 3, and small differences within a grade did not affect the price.

In the fall of 1944 this Experiment Station and the Experiment Station in Georgia started the work of trying to determine the cause of concealed damage and the effect of environmental factors on its development. Within two years most of these details had been worked out. Fortunately, the Florida Experiment Station released the Dixie Runner peanut about that time; since our experiments had shown that it was highly resistant to concealed damage, we immediately recommended it. As a result concealed damage is not a serious factor with us now. -- ALABAMA POLYTECHNIC INSTITUTE, AUBURN

CALIFORNIA

By Wm. B. Hewitt

Milo Root Rot. After 1935 Milo root rot very rapidly became a limiting factor in the production of Milo in areas of California. This was particularly so in the Delta of the Sacramento River where root rot was first recognized in 1935. By 1938, most of the plantings were infested and losses varied from only a trace in some plantings to 100 percent in many others.

Acreage estimates in thousands of acres of Milo harvested each year from 1935 to 1941 were as follows: 136, 114, 136, 136, 136, 99, 135, and 204. Yields in bushels per acre for the same period were respectively reported as 36, 36, 33, 34, 32, 36, 36. Since that time the yield has stayed above 36 bushels per acre except in 1944 when it was about 35.

The selection and development of resistance in varieties progressed very rapidly as the disease spread. So, by 1940, seed of these new selections, particularly Double Dwarf Milo 38, became generally available to growers.

Pierce's Disease of Grape. Between 1936 and 1941 approximately 3,500 acres of vineyard, mostly the variety Thompson seedless grown for raisin, were destroyed by Pierce's disease in the Chowchilla area in Madera County. Much of this land has since been planted to alfalfa, permanent pasture and annual crops such as cotton, grain, potatoes, etc. Dairying has been developing in this area for several years. The pattern for this change was therefore, established, but the disease certainly hastened the change of this acreage.

A change very similar to this has taken place between 1940 and 1947 in the area near Kerman, in Fresno County. Over these years many vineyards have been removed after Pierce's disease destroyed from 25 to 30 percent of the vines. Much of this land has been planted to alfalfa, cotton, milo, etc.

The disease alfalfa dwarf is caused by the same virus as Pierce's disease of grape. Vectors which spread the virus in the Fresno area, particularly Draeculacephala minera, develop freely in the alfalfa plantings infested with dwarf which often suffer heavy loss.

Curly Top of Beets. Curly top was formerly the limiting factor in sugar beet production in several areas of California as well as in other western States.

Severe outbreaks occurred in 1899, 1900, 1905, 1914, 1919, and 1925. By 1930 resistant varieties of sugar beets were released and during the next few years the older varieties were almost completely replaced by improved resistant types. During the same period the beet sugar processing companies undertook direct control measures against the beet leaf hopper in its breeding areas.

As a result of these two developments, along with improved cultural practices, the sugar beet industry has revived and expanded.

In 1925, when curly top was so severe, the yield in California was only 6.5 tons per acre on 76,000 planted acres, and during the next five years the planted acreage averaged only 53,000 acres per year. By comparison the average planted acreage for the five years, 1938 to 1942, after resistant varieties were in general use, was 170,000 acres per year.

Similarly, the average yield of beets from 1918 to 1927, including two severe curly top outbreaks, was only 8.27 tons per acre, whereas from 1938 to 1947 the average yield was 16.01 tons per acre.

Much of the improvement in both yield and acreage is due to improved cultural practices and better selection of land, but without curly top control this remarkable revival of the industry would not have been possible.

Sclerotium Rot. By 1933 the attack of Sclerotium rolfsii upon sugar beets was so frequent and so severe in certain areas of the Sacramento Valley of California that it appeared doubtful that growers could continue to produce this crop. Following a careful study of the problem a number of control measures were introduced. These included: (1) checking the spread of the fungus by proper handling of screenings from sugar beet loading stations, of wash water from sugar factories, farm machinery and livestock from infested fields; (2) crop rotation with nonsusceptible or winter crops to prevent multiplication of the fungus; (3) indexing of fields to determine fungus populations as an aid in avoiding heavily infested fields; and (4) use of nitrogenous fertilizers to reduce infection.

As a result of these improved practices the losses from this disease have been reduced to a low level and sugar beet production has continued

in a proper rotation even in the most heavily infested areas.
UNIVERSITY OF CALIFORNIA, BERKELEY

CALIFORNIA

By H. Earl Thomas

Apricot and prune trees in the Santa Clara Valley killed by *Armillaria* (PDR 29: 495-6. 1945) are usually replaced by Persian walnut on *Juglans hindsii* root. Some of the latter will no doubt succumb after 8 to 15 years to the disease called black line.

The loganberry, a leading berry variety in Sonoma County 25 or 30 years ago, is virtually extinct due chiefly to a virus disease (Phytopath. 38:919. 1948).

Discovery of nematode resistant peach root and a cure for little leaf (zinc deficiency) has revived peach and almond growing in considerable areas of the San Joaquin Valley.

It is becoming difficult to find good land which has not grown tomato or cotton in recent years. These crops in some way build up *Verticillium* for succeeding crops. UNIVERSITY OF CALIFORNIA, BERKELEY

CONNECTICUT

By Albert E. Dimond

The information requested regarding crop industries which have been revived due to the development of disease control methods has, it seems to us, this fallacy which you may have already allowed for. In some sections of the country the growers are not organized into groups and do not present their point of view so rapidly to the Experiment Station that the research man can find the answers for them. Often they do not know what is wrong with their crops. In such instances there may be a considerable lag between the time a new disease appears in an area, and the time when a solution is found for the disease; and in such instances there will likely be a considerable reduction in the amount of the crop planted until the solution is found. The people who know the history of the situation best here can cite instances where rapid diagnosis, lucky or prophetic research, and efficient distribution of this information have prevented a new disease from assuming serious proportions.

Turning to the first category where changes in crop industries have been caused primarily by plant diseases, one might list the following, without particular attention to the importance of the several crops.

Rust on blackberries and raspberry mosaic have certainly reduced the amount of cane fruits planted, whether the plantings be in backyard home gardens or on a commercial scale.

The white pine blister rust has eliminated the growing of black currants, and has seriously reduced the plantings of white pine.

Combined with a labor shortage, Diplocarpon and one disease which appears to be new to this area will seriously affect strawberry plantings if the growers do not heed the control procedures already worked out for them.

Another case where control is known but growers may reduce crop plantings because of failure to heed these control methods are peaches when attacked by X-disease. "Little peach" is gaining in incidence, and that may reduce peach plantings.

Dutch elm disease has certainly affected the sales of American elm by nurseries, and the plantings in turn by nurserymen.

Willow scab has in the past seriously affected the amount of willows sold.

Chrysanthemum nematode has been a great source of trouble and has affected the crop specialties of ornamental growers.

Plantings of European poplar have been affected by canker.

The second category requested we cannot supply too much information about. The list in the paragraph just above includes the X-disease of peach and the fruit rot of strawberries, both diseases having assumed proportions where crop plantings might be affected, but the controls have been provided in advance of any necessity for reducing the crop. Blue mold of tobacco in Connecticut is in a similar category.

We have never suffered from a shortage of potatoes, but certainly the acreage of potatoes, and the production per acre has increased as a result of developing better insecticides and fungicides spray program. DDT and Dithane are primarily responsible for this situation in Connecticut. CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN

IDAHO

By C. W. Hungerford

In about 1920 when I first came to Idaho there was a sugar beet factory located at Nampa in the southwestern part of the State. The factory closed due to the fact that sugar beets could not be grown successfully in that area because of hazards due to the curly top disease. Through the combined efforts of the U. S. Department of Agriculture and the cooperating States, several beet varieties have been developed which are resistant to curly top. A new million dollar factory was built at Nampa and another was built at Nyssa, Oregon, just across the line from Idaho. Both of these factories have been operating to full capacity and this has all been made possible by the development of curly top resistant sugar beet varieties.

When I came to the State the field beans in southern Idaho were almost 100 percent infected with common mosaic. In 1925 we began a program of bean improvement and since that time, have developed selections and varieties of all the common field beans which are resistant to common mosaic and to curly top. This improvement program has not only stabilized the industry but has allowed field beans to be grown in many areas where it was impossible to grow them successfully before due to curly top. All the field beans certified by the Idaho Crop Improvement Association are numbered University of Idaho introductions.

Bacterial wilt in alfalfa appeared in southern Idaho in the irrigated section, especially in the southwest and south central areas, and developed rapidly until it was impossible to keep stands of alfalfa more than 3 or 4 years. Previous to the time the disease appeared, many fields were left in alfalfa for 12 to 15 years. This disease changed the program of crop rotation, interfered materially with certain livestock types of farming and reduced the total acreage of alfalfa quite materially. The development of resistant strains of alfalfa is solving this problem.

The vegetable seed industry has, through the years, been forced to move the growing of vegetable seeds due to losses from plant diseases. The bulk of the vegetable seed of the United States is now western-grown; a very large percentage of it in the State of Idaho. Some seed companies have grown infected seed in the West in order to free this seed from seed-borne diseases. Efforts have been made through the years to protect this area from the introduction of those diseases which might cause severe losses under our growing conditions. Infected roots of carrots and other vegetable crops have been shipped into the State, and in the case of carrots bacterial blight and aster yellows have been introduced. One area near Caldwell, Idaho, discontinued the growing of carrot seed because of losses due to these diseases. A method of seed treatment has been developed by the Plant Pathology Department which has proven successful in controlling bacterial blight. A program of control for aster yellows has also been developed. UNIVERSITY OF IDAHO, MOSCOW

ILLINOIS

Benjamin Koehler

In Monroe County the hazard of growing a crop of either red or sweet clover has become so great that the farmers have just refused to grow it any longer. That, of course, is very important from the standpoint of keeping up soil fertility. As a result of this pressure from him and, to a lesser extent, from a number of other farm advisers in that general area, we employed Dr. J. W. Gerdemann on September 1 to work on legume diseases.

During November corn spoiled in the cribs in northern Illinois. The two main causes of trouble seem to be too early harvesting and inadequate facilities for proper cribbing. We are told that many farmers were through harvesting by November 1 whereas they should not have started until after that date. The yields were unusually high and farmers not only overloaded their regular corn-drying cribs but also constructed temporary cribs. After filling the regular spaces in the usual double cribs they proceeded to fill the driveway also. This, we are told, is true probably in the majority of farms. Temporary cribs were made from snow fences and were usually too large in diameter. We have also had an unusual amount of warm damp weather this fall. All of this together is causing a good deal of spoilage.

None of the corn in northern Illinois is dry enough for farmers to be able to get a federal loan on it. Some cribs are actually hot and steaming, and in some cases farmers have unloaded those and taken the corn to elevators at a price of only 35 cents per bushel. The weather has now turned cold enough to check spoilage except in those cribs which are generating their own heat. There are companies that make portable drying units for farm use, gasoline heated with blowers run by electric or gasoline power. All available equipment of that kind, we understand, has been purchased and is in use in that area.

Reports of this spoilage have come from Stephenson, Carroll, Boone, Ogle, and McHenry Counties. A check made by some of the federal grain men indicated that the moisture in the cribs in that general area ranges from 24 percent to 36 percent whereas only 20 1/2 percent is allowable for federal loans. UNIVERSITY OF ILLINOIS, URBANA

MAINE

By Donald Folsom

The present hazards include both new and old disease problems. Potato bacterial ring rot became a new disease in the early thirties. It is being controlled quite well through a zero tolerance in certified seed and by sanitation and disinfection. Leafroll with its resulting net necrosis first became severe in Aroostook County in the 1937 crop and has resulted in considerable displacement of the Green Mountain variety by the Katahdin variety. Control is being effected through use of Katahdin, which is somewhat resistant to leafroll and immune to net necrosis, and through foundation seed plots and the Florida winter test. Blackleg and late blight have remained as more or less hazards although control has been advanced by proper handling of the seed in the case of blackleg and by the elimination of many dump piles in the case of late blight. The use of top killers has helped to control leafroll and late blight but has introduced a new difficulty, vascular discoloration.

Under revival of crop industries might be mentioned the improvement in the available potato seed stock through foundation seed plots, the Florida test, and possibly the use of DDT.

Results of Florida Winter Tests of
Maine Potato Seed Stocks, 17 Varieties, 1939-1947*

Crop year	Samples tested	Samples good enough to recommend stocks
	No.	%
1939	215	56
1940	210	49
1941	396	55
1942	403	50
1943	609	66
1944	971	27
1945	1218	44
1946	1551	80
1947	1555	81

*Most improvement in 1946 in Chippewas, least in Katahdins which were already good in previous years. Other leading varieties (Cobbler, Green Mountain, and Sebago) showed intermediate improvement. Chippewas in previous years were hurt by leafroll.

MAINE AGRICULTURAL EXPERIMENT STATION, ORONO

MASSACHUSETTS

By Oran C. Boyd

Revival of Crop Industries: Since the arrival in recent years of virus-resistant raspberry varieties on the market, considerable interest has been revived in commercial raspberry growing in this State, and also in the growing of nursery stock within the State.

Changes in Crop Industries: The large acreage of seed onions in the

Connecticut River Valley of a few years ago has nearly disappeared, and has been partially replaced by raising of set onions, due to the losses from "blast" and thrips.

As a result of the development by C. V. Kightlinger of black root-rot resistant strains of the Havana seed tobacco variety, at least half of the acreage now devoted to Havana tobacco in this State is planted to No. 211, K1, K2 or K3.

Owing to the objections by potato buyers and users of net necrosis discoloration in Green Mountain potatoes raised in high elevation sections of the State, the acreage there formerly devoted to Green Mountain has shifted almost entirely to varieties that do not develop net necrosis, mostly Katahdins.

A new attitude of encouragement is being assumed by commercial vegetable growers toward the growing of head lettuce since the discovery of a sure practical way of controlling the Aster Yellows disease (with DDT for the vector leafhopper).

As a result of the destructive nature of Peach X-Disease, considerable interest has been lost in the past 10 years in commercial production of peaches.

New Disease Problems: Our carnation growers are becoming deeply concerned about the Bacterial wilt disease of carnations, which was introduced apparently in recent years. Information is needed on the distribution, seasonal behavior and control of that disease.

There is a growing belief that at least some phases of the root-rot diseases of tobacco in this State are attributable to members of the meadow nematode group. Information is badly needed on the prevalence of black and brown root-rots in relation to kinds and abundance of nematodes, soil types, etc., as well as on the control of harmful nematodes in tobacco-soils. UNIVERSITY OF MASSACHUSETTS, AMHERST

MINNESOTA

By R. C. Rose

A few cases where a crop program has been affected by diseases are listed below:

Aitkin County some years ago had a thriving business in raspberry production. Mosaic disease was largely responsible for its being almost eliminated today. Very few plantings are left.

Dodge County once led as a cabbage producing county. Today the county's commercial production is gone. Reason: black rot and blackleg mostly.

The cabbage industry of Carlton County only a few years ago was on the way out like that of Dodge County, but instead adopted hot water seed treatment and a sanitation program and the industry has survived and is growing.

A few years ago *Phoma* rot in rutabagas was taking heavy tolls in Pine County and farmers were planning to drop this crop. Disease control methods have statilized production on this important cash crop for which the county is famous.

In recent years many potato farmers have dropped potatoes owing to losses from ring rot.

Many vegetable growers around Duluth, St. Paul, and Minneapolis have ceased to grow cabbage because of soils contaminated with club root.

Pickle companies in Minnesota have moved their field of operators a number of times after farmers lost interest in the crop because of falling production espedially after epidemics of mosaic disease.

In southern Minnesota the barley acreage has fallen rapidly during the war years. Root rot and low yields rather than market price were the cause.

Had it not been for the new varieties of oats that resist Victoria blight, the oat acreage would have receded greatly in the last two years. UNIVERSITY OF MINNESOTA, ST. PAUL

NEBRASKA

By Arden F. Sherf

Throughout the years, Nebraska has had certain agricultural areas which have shifted crops due to disease difficulties. We have one area in western Nebraska in Scotts Bluff County in which potato scab has become so serious as to have prohibited commercial production of the Bliss Triumph, which is our most common variety. The only potatoes grown in this area are of the russet type which have more resistance to this disease.

In addition to this instance, I might mention a small area in Sioux County and another one in Cheyenne County which formerly grew a considerable acreage of potatoes, but in recent years the soil-borne *Fusaria* have become of so much importance that potato production has become of minor importance. There have been other instances of threatened crop destuction in specific areas such as Bacterial wilt of alfalfa which has been controlled by the development of resistant varieties and more recently Victoria blight of oats for which resistant varieties have also been the answer. UNIVERSITY OF NEBRASKA, LINCOLN

CHANGES IN CROP INDUSTRIES IN NORTH DAKOTA CAUSED BY PLANT DISEASES

By W. E. Brentzel

Crop diseases often have brought about changed plans and practises in North Dakota. Sometimes the cause of these changes may or may not be known since growers automatically change when profits cease. In many cases the cause for the changes are known to be diseases and a few instances may be cited:

Grain rust epidemics have frequently caused local, if not regional, changes in production. In the years 1904 and 1916 major losses in the grain crop occurred and seriously threatened the industry. Other serious rust epidemics occurred at frequent intervals since 1916, one as late as 1935. By changing to rust resistant varieties and by eradicating the barberry bushes the industry was saved. Pathologists have had a major part in the work of developing these varieties of wheat and other grains and in the destruction of barberry bushes. This work has added untold wealth to our country as a whole.

The flax wilt problem paralleled the cereal rust problems in respect to time. This disease, it appears, chased flax production almost out of the U. S. The flax crop followed closely on the opening up of new lands. After a few crops of flax had been taken, the land became infested by the wilt fungus, resulting in the abandonment of flax-growing and the substitution of some other crop. When the new lands became scarce flax production moved out and for a number of years the crops survived only in the northwestern prairie States, largely in the Dakotas and Montana where grass lands could be found. It was not long until even these regions of new land ran out and something had to be done to save the flax industry. It was necessary to demonstrate the cause for the wilt of the crop and and to develop control measures. This creditable work was done largely by one of the earlier pathologists, Dr. H. L. Bolley. The cause for the wilting was shown to be a fungus, Fusarium lini [F. oxysporum f. lini], and the methods for control were subsequently developed. Through the efforts of this man and without much assistance we may say that the flax industry was saved. Since the details for control have been worked out the methods seem simple enough. At present the grower of flax may be assured that the crop will not be destroyed by wilt.

Since 1940 the flax industry again ran into trouble. Certain high yielding varieties of excellent quality were introduced to growers. Because of the merits of these varieties it was not long until they were selected for a large portion of the flax producing area. Although susceptible to one "minor" disease, pasmo, they were resistant to the major diseases, wilt and rust. Unfortunately the minor disease pasmo did not remain insignificant. Growing these varieties over large areas resulted in the building up of the pasmo fungus Septoria linicola [Mycosphaerella linorum], and after a few years so much of the fungus was harbored about the land that the entire flax acreage was threatened. The disease was promptly recognized by pathologists in its new role of large scale destruction. Since this experience all varieties that are susceptible to the pasmo disease have been replaced by resistant kinds.

A number of minor crops may be cited as other examples. During the drier years the tomato crop was threatened by the fungus Septoria. While we were having the difficulties with this disease in tomatoes the flax crop was being seriously damaged by the pasmo disease. This fungus has a wide range of hosts and it appears that it may have included the tomatoes and a few other minor crops in its role of destruction. While this may not be entirely true, circumstantial evidence points strongly in this direction. Since pasmo resistant varieties of flax have replaced the susceptible kinds we have not noticed very much Septoria infection on tomatoes and other crops.

Other minor diseases that seem to have potential greatness are the loose smuts of wheat and barley. The favored varieties now, unfortunately, are susceptible to these diseases. In a few local areas growers have become very much concerned over losses from loose smut. Up to the present time this is one of the problems that has not been satisfactorily solved.

The potato industry is constantly confronted with new disease problems resulting from the introduction of new seed lots into our State. In 1920, about the time when the potato industry began its development in North Dakota, there were relatively few diseases prevalent in this region. Today, on the contrary, there are relatively few diseases that do not exist here, having been introduced almost entirely by importations of new seed lots. At the present time the potato industry in this State lies about 90 percent on the shoulders of plant pathologists. Without disease control and regulation this perishable crop certainly could not exist very long. By the introduction of new control measures (including new chemical sprays), by careful selection of seed stocks and elimination of diseased lots, and by the development of new varieties resistant to diseases, the potato industry is able not only to thrive but to increase at a comparatively rapid rate. NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION, FARGO

OREGON

By J. R. Hardison

Blind Seed Disease. In Linn County there are a number of farmers whose livelihood depends almost entirely upon perennial ryegrass seed production. In some cases practically no income was realized for a year, because the seed produced was unsalable due to blind seed disease. In other cases, infested fields have been sold to unsuspecting new owners who could not sell subsequent crops. I have no information of loss of farms, but several farmers are in questionable financial straits because crops were not as good as anticipated. Mr. Mikesell may have these records for Linn County. Certainly the perennial ryegrass farmers' lives have been changed because successful seed production now depends on practice of effective control measures. The Linn County planning commission recognizes blind seed disease control as the critical operation in perennial ryegrass seed production.

Ergot. Ergot is apparently responsible for considerable sickness and occasionally death of livestock, especially sheep in the Willamette Valley during the fall months in perennial ryegrass pastures.

Grass Seed Nematode. This disease is the critical problem affecting seed production of chewings fescue, astoria bentgrass and seaside bentgrass. Effective control measures are available for chewings fescue but not for the bentgrasses. Losses of 50 percent of the seed crop are not uncommon.

Grass seed nematode galls are recognized as toxic to sheep, cattle and horses. Many fatal cases have resulted from feeding nematode gall infested screenings from chewings fescue seed crops. OREGON AGRICULTURAL EXPERIMENT STATION, CORVALLIS

PENNSYLVANIA

By R. S. Kirby

From our experience, the most striking example was the chestnut blight which nearly completely destroyed the chestnut crop of timber and nuts.

Another example would have been stem rust on oats in the northern part of the State. Stem rust was so severe in many of the northern Pennsylvania counties that the farmers practically gave up growing oats in the late 1920's and early 1930's. Barberry eradication was started about 1935 and as soon as the barberries were removed, oats production immediately came back and was a very important crop in this whole area, which is largely devoted to dairying. A careful study made on 168 farms where oats were grown and where varieties, fertilizers, or other cultural practices had not been changed showed that for the five years before barberries were eradicated the average yield was 17.4 bushels an acre. For the five years following barberry eradication the average yield was 39 bushels an acre.

In raspberry production, mosaics, leaf curls and anthracnose have practically driven raspberries out of the small garden and farms of the small growers and in many cases off the farms of the larger growers. If these diseases could be controlled raspberry production would be three to five times the present yield. Those growers who do practice measures to control these diseases have been very successful.

Helminthosporium blight on oats caused crop failures or heavy losses where the varieties Vicland, Tama, and Boone were grown. If resistant varieties had not been available, this disease was well on its way to driving oat production out of Pennsylvania.

On tomatoes and potatoes, late blight would, in certain years, ruin the crop and discourage many growers from further production if it were not for the control programs. The reduction in acreage in both potatoes and tomatoes comes largely from the small grower who is not equipped to spray. On potatoes, ring rot has been a threat as great as or greater than late blight. If it had not been for the finding of resistant varieties and the development of effective control measures many growers were so discouraged that they would have gone out of the potato business.

Smuts of oats, wheat and barley have at times seriously threatened the continued production of these crops. Only the adoption of control measures has made it profitable for growers to continue production.
PENNSYLVANIA STATE COLLEGE, STATE COLLEGE

TEXAS

By A. A. Dunlap

Following are some observations that I have made since being in Texas and some reports of serious plant disease instances that have been handed down from other years.

I have been told of an attempt made several years ago to start a pear industry in the Gulf Coast area below Houston. It seems that this attempt failed due to the severe epidemics of fire blight which ruined the orchards.

About four or five years ago large farming areas in Zavala County were abandoned by spinach growers because of the high incidence of white rust nearly every year.

Growers of Irish potatoes in the Texas Panhandle areas, particularly in Floyd, Deaf Smith, and Dallam Counties, found it impossible to raise late summer and fall crops of potatoes owing to the severity of early blight at that time of the year. They confine their crops now entirely to plantings that can be made as early in the spring as possible.

A rose grower in Tyler once told me of a nurseryman who attempted to raise rose plants in Wilson County and was forced to abandon his business there due to the prevalence of crown gall. We suspect that the crown-gall organism may be sort of native in some of our Texas soil types.

Up until the time some resistant strains of oats and wheat have been developed, it has been impossible to raise these small grains in any of the South Texas area due to the prevalence of leaf rusts.

It was once reported to me that originally there was a packing shed for tomatoes here in Bryan but the green wrap tomato industry was abandoned here apparently due to some disease like southern blight.

We have had many cases of cotton farms that were abandoned apparently on account of prevalence of cotton root rot in the fields. AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS, COLLEGE STATION

TEXAS

By P. A. Young

In 1945, some of the farmers who bought slip tomato plants from the Lower Rio Grande Valley of Texas had the misfortune to get plants that were infected with Phytopthora infestans. Cool rainy weather followed transplanting of these tomatoes into fields near Jacksonville, and late blight became epidemic. It not only destroyed the tomato plants from the valley but also spoiled the tomato seedlings in the hot beds and cold frame near them. Two of the farmers quit farming after the failure of their tomato crops.

Near each farm in this region, there is one patch of ground that is most convenient for a garden, and these patches have been used for gardens for many years. Sooner or later, these patches (gardens) become infested with root-knot nematodes that decrease yields and quality of many garden plants thereafter.

Tomato slips from the Lower Rio Grande Valley brought Verticillium wilt into at least four tomato fields in Cherokee County in 1947. These were the first records of this disease in this part of Texas.

Blossom-end rot of tomatoes often is very destructive here. About 1938, a farmer in one community lost nearly his whole crop of tomatoes because of blossom-end rot. Faulty use of fertilizer seemed to be the main explanation. I discussed the problem with him in his field at that time. He has since then been a very successful tomato raiser.

In 1948, two farmers tried fields of Grothen Globe tomatoes. They lost at least half of their tomato crop due to the damage from blossom-end rot in this very susceptible variety.

Bacterial spot (nailhead rust) is the epidemic disease of tomatoes in this region. In rainy weather in May and June, this disease destroys the crops in many fields of tomatoes.

In 1941 from June 10 to June 20, Alternaria solani spread like a prairie fire, with the aid of a few warm rains to spread the spores. Early blight destroyed at least half of the tomato leaves in about 5 counties in and near Cherokee County, Texas. The tomato sheds closed in surrounding counties, but farmers in Cherokee County had dusted or sprayed their tomatoes with copper enough so that they finished selling their crops in Cherokee County. This is the only major epidemic of early blight of tomatoes that I have seen. TEXAS AGRICULTURAL EXPERIMENT STATION TOMATO DISEASE LABORATORY, JACKSONVILLE

WEST VIRGINIA

By J. G. Leach

Because of the nature of agriculture in West Virginia, we do not have many specialized crop areas where diseases have strikingly changed or limited crop production.

The most outstanding example of a disease hazard is that of watermelon wilt. Up until about 20 years ago, there was a fairly extensive area of watermelon production in the western part of the State along the Ohio River in Mason, Jackson and Wood Counties, but this has largely been eliminated due to the ravages of Fusarium wilt.

I also know from observation of one other small area in the vicinity of Buckhannon, West Virginia. Here an attempt was made to grow strawberries on a commercial scale. A black root rot of uncertain cause has been a decided limiting factor in the development of this industry.

Some commercial tomato growing industry has developed in Morgan County. This industry was seriously threatened by late blight during the past 6 or 8 years and it was saved only by the organizing of spray rings under the direction of our Extension Plant Pathologist.

In the Canaan Valley there was an attempt to establish head lettuce production but within two years after the start of commercial production there, before the acreage had exceeded 25 acres, the widespread occurrence of aster yellows proved a limiting factor and there probably will not be much further development. WEST VIRGINIA UNIVERSITY, MORGANTOWN

WYOMING

By G. H. Starr

You have asked for information on changes in crop industries in this State caused primarily by plant disease and a revival of crop industries due to the development of disease control methods.

To the first part, I think of one example in Wyoming. This change was due to the presence of Fusarium wilt (eumartii) in a small area south of Torrington in central eastern Wyoming. This was a dryland area where several growers quit the potato industry in about 1932-34 and switched to the growing of wheat. Fusarium wilt was very prevalent and I have observed it as high as 75 percent in some of those fields.

To the second portion, I think also of one example. This is the revival of the potato industry near Powell, in the northern central portion. This area used to produce approximately 1,000 cars, however, in the year 1935 or there-about, this area was practically out of the potato industry primarily because of the prevalence of psyllid yellows and ring rot in potatoes. Now, with known methods of control and the application of them, this area is gradually coming back into potato production, although it will be some years before they get back to the one-time peak production.

UNIVERSITY OF WYOMING, LARAMIE

II. EFFECTS OF LOSSES FROM PLANT DISEASES ON FARM LIFE

Reports from County Agents

1. EFFECTS ON GROUPS OF FARMERS

1920-1940

Granville wilt of tobacco was discovered in Granville County, North Carolina, 30 or 40 years ago. About 7000 acres of tobacco were grown on 1500 farms in the southern half of the County. The farm families had owned and operated the farms for generations in some cases. The disease destroyed 20 to 50 percent of the crop each year; the loss amounted to from 1to 2 million dollars annually, depending on the price of tobacco. Crop rotations, land sterilization, a variety of chemicals etc., were tried in attempts to control it. A great number of farmers lost their farms. Those who were able to keep theirs did patch farming, trying to select land free from wilt. The farmsteads deteriorated. Many farmers became irritable and noncooperative. Education was neglected; hundreds of boys and girls failed to get college educations because of this disease. Standards of living and health dwindled to a low ebb. A wilt-resistant tobacco finally was developed, but it took more than 20 years of research. Remarks: Loss from forced sale of farms at sacrifice and the loss from tobacco sales amounted to from 30 to 40 million dollars from 1920 to 1940. --C. O. Morgan

1935

Stem rust caused practically complete loss, in the majority of cases, on about 700 wheat farms in West Polk County, Minnesota. The average yield expected was 20 bushels to the acre, whereas none at all to 50 percent yields were obtained. Thousands of acres were burned. The total loss was about $400,000. Some farmers had to quit. Many took five to seven years to recover because wheat was the main crop at that time. The loss stopped all progress in family living standards. -- Carl T. Ash

1940-1948

Nematodes and Phymatotrichum root rot caused loss in farm and garden land in Andrews, Crane, and Ector Counties, Texas, including 600 acres of truck crops and gardens and 11,000 acres of cotton. Loss averaged 50 percent, amounting to $35 per acre. Three-quarters of a bale of cotton per acre was the expected yield, whereas one-third bale was harvested. Living standards were lowered and no improvements were possible. Remarks: Soil treatment with dicloropropane-dichloropropene was used to control nematodes; grain sorghum was planted on land infested with cotton root rot organism. Truck crops have been discontinued; only small garden plots where the soil can be treated on a small scale are planted now. Farming is mostly grain sorghum in this area. Very little cotton is grown because of cotton root rot. Four-year rotations have helped farmers to recover financiallly. -- Alton E. White

1946-1947-1948

Ten to fifteen thousand acres of cantaloupes and honeydew melons in Imperial County, California, have suffered heavy loss from cantaloupe mosaic each year. The disease has been common in all plantings since 1946. To control it growers have tried various cultural practices, and used all new and established aphicides to control the green peach aphid. Of the expected 150 to 160 crates per acre, only 90 to 93 were obtained. The whole melon industry is seriously affected and some of this operation is being transferred from this area. Other growers have stopped growing melons. This is a serious economic loss which affects most people in this area -- many groups besides farmers, including laborers, shed crews, and general business. -- John E. Swift

1948

Wheat smut (covered smut) has caused heavy losses on 1208 farms totalling 40,000 acres in Union County, Oregon. The farmers followed good farming methods and had owned their farms for periods of 10 to 40 years. The disease is common and has been increasingly severe. Farmers have used seed treatment to control it. The loss was estimated at 13 percent; the average expected yield was 37 bushels whereas 32 bushels was harvested. The total loss for the county amounted to $380,000. Reduction in farm purchasing value affected farm equipment and family necessities. To recover from the loss required going without some of the necessities. -- R. W. Schaad

Cumulative

Six to seven thousand acres growing peas in Imperial County, California, suffered loss from root rot, which was common on repeatedly cropped land. To control it farmers plow under Sudan grass and make large applications of Areo-Cyanamid and soil treatment chemicals. No loss of farms has resulted but yield is low and income is poor. Because of the root rot, many acres are planted to crops which bring smaller incomes than peas. The overall family income is reduced in some areas. Remarks: Although this disease has not been sensational in its effect it has gradually caused a reduction in pea acreage in this area and a resultant loss in income from a large cash crop. -- John E. Swift

There is a serious sweetclover disease situation in Monroe County, Illinois, at the present time, but losses resulting are not specific enough to cause farm foreclosures. The disease seems to have built up where sweetclover has been grown in rotation for a considerable period, since it is not so severe on soils seeded to this crop for the first time, even though the soil might be low in fertility. Therefore, production of farms on a low fertility level might not be so badly affected as that of more fertile farms. We have been worried about this situation for several years. Sweetclover has made Monroe County, and this disease if not controlled, will un-make the County more rapidly than it was made. Instead of an individual bankruptcy, we will be heading for a county bankruptcy, so to speak, if the problem is not solved. We are changing to alfalfa as quickly as is practical, but in a cash grain area that cannot be done very readily. The $64 question in Monroe County during the last few years has been, "What are we going to do about sweetclover failures?" The common expression sums it up: "When we first started growing sweetclover, it got as high as a horse's back, and now it won't hardly hide rabbits!" -- Edgar S. Amrine

2. EFFECTS ON INDIVIDUAL FARMERS

1914-1918

The farmer was the life-time owner of an average-size farm in Lake County, South Dakota. Leaf and stem rusts caused loss to small grains. Barley yield was reduced from 30-50 bushels per acre to 10-20, oats from 40-60 to 5-15, wheat from 20-30 to 2-5. The loss amounted to $1000 to $3000 per year. Two sons worked their way through college with very little help from home. Money was borrowed during this time of crop failure, and low farm prices on top of this loss caused foreclosure of the home farm when the depression was at its worst, in 1934. The sons went into other work. Remarks: At that time no control methods were known. Before plant pathologists and breeders were able to develop new disease-resistant varieties it was a "plant and hope" proposition. If weather was not conducive to plant diseases a crop was raised. If it was damp, foggy and muggy usually a very heavy loss resulted. Crop diversification, corn, alfalfa, and pastures saved the day for most farmers. -- Harmon Boyd

1917-1930

The farmer-owner had operated his 200-acre farm, large for the region, in Watauga County, North Carolina, for several years. Club root, a comparatively recent introduction to the area, caused heavy loss to cabbage. Usually 25 to 75 percent of the crop was destroyed. The farmer was forced to change his crop rotation, growing cabbage on high land that was less productive. He suffered a reduction in income that resulted in a lower standard of living. He finally recovered from his loss, but it took ten years or longer. Remarks: The disease appeared in this section about 1910, but did not become serious until after the flood of 1916, which spread the organism over creek and river bottoms; by further movement with farm machinery from field to field the disease soon became widespread. For a few years following 1916 it was severe. The grower stated that in 1923 he cut 300 pounds of cabbage from one seven-acre field where he was expecting a yield of approximately 140 tons. After this he turned to less desirable cash crops and more livestock. Neighbors said that for several years he had rather a fight to hold his farm, but the farmer himself will not admit it. -- L. E. Tuckwiller.

1920-1948

Phymatotrichum root rot caused 25 to 50 percent loss to alfalfa on a farm in Wichita County, Texas, operated by the owner for ten years. The yield was only 2 tons per acre, whereas 5 tons had been expected. The loss amounted to $60 per acre. Lowered income resulted in less education for the family. Hubam clover was planted in an attempt to overcome the loss, but the farmer has not yet recovered completely. -- J. M. Carpenter.

1928-1935

Apple scab caused heavy loss on a 70-acre farm, small for the region, in Snyder County, Pennsylvania. The farmer had owned it for 20 years. In 1928 he sprayed with materials not recommended by the College, and lost 80 percent of his crop. From 1500 bushels expected yield, he got 300 bushels of poor quality. The trees were weakened so much as to affect future crop years' production. Succeeding drought years, in 1930 and 1932, killed outright 15 percent of the trees weakened by the disease attacks. The orchard has never completely recovered from the damage. Extensive annual borrowing has been necessary ever since, to produce the crop. The loss seriously affected the financial stability of the family (man and wife, no children), and caused the man to seek another job. He is now working full time in a welfare institution. The farm is mortgaged and liened to such an extent that the owner would be glad to sell for the amount of indebtedness. Remarks: Whereas this orchard had been a debt-free enterprise, it is now so very heavily tied up in financial obligations as to affect the crop production question. There is no longer any independence of thought and action by the operator. -- Ira L. Yoder

About 1930 and 1931

The tenant, a good farmer, had operated an average-size farm in Pinal County, Arizona, for two or three years. Three hundred acres of lettuce were grown. Watery brown rot had appeared in the region one or two years previously. No attempts were made to control it; the disease was new and after diagnosis no control method was known. The crop loss was 90 percent; 25 packed crates or less were obtained out of an expected 250 packed crates per acre. Some lettuce that appeared to be all right in the field was discarded at the shed. The loss involved an estimated $40 an acre in growing costs, and $250 per acre in anticipated profits.

There were no effects apparent in the family standard of living. The operator took his loss and moved to another county where he farmed and handled cattle. Later when he ceased farming operations he sold his farming equipment, and since that time has engaged in a range livestock business, apparently quite successfully. -- K. K. Henness

1932

A farm in Marion County, South Carolina, with 90 acres of cropland, had been farmed by the owner, a good farmer, for 50 years. Flue-cured tobacco was grown on 15 acres. Blue mold appeared in 1932. The farmer tried to control it by spraying with copper sulfate, but the disease caused loss estimated at 70 percent due to seedbed damage resulting in unthrifty plants and delayed transplantings with consequent poor growth and small yield. The yield obtained was 300 pounds, out of an expected 1150. The loss amounted to $2500. Purchase of needed farm machinery was delayed; standards of living lowered; one son was prevented from entering college. By following new methods of control, the farmer recovered financially after six years. -- D. Austin Shelley

1934-1936

A 165-acre farm in Montgomery County, Iowa, had been farmed by the owner for eight years. Barley scab caused trouble; the disease was fairly common in the area but was new to this farmer. Approximately 33 or 34 bushels per acre was expected, but the average yield of scab-free barley for two years was 8 to 10 bushels. The loss amounted to about $15 per acre each year for the two years. The crop was grown for sale and for feeding, the latter causing most loss. Three calves were lost from feeding scabby grain. Family living standards were lowered; less money was available for necessities, and luxuries too. It took two years to get over this loss. Remarks: This man was weakened financially owing to the depression. -- S. L. Dunn

1935

Stem rust caused complete loss in 165 acres of wheat on an owner-operated farm in Lac qui Parle County, Minnesota. The loss amounted to $4000. The mortgage was foreclosed; the family suffered a lower standard of living. The farmer only partly recovered his former status. Remarks: Wheat rust on this farm in 1935 was the final factor in the foreclosure, although not the only thing that brought it about. In some other instances in 1935 loss from rust to wheat and barley made foreclosure necessary: one was a 400-acre farm valued at $16,000, with a crop loss for the year amounting to $2000; another was 1100 acres, valued at $25,000 with crop loss amounting to $4000. -- Wayne Weiser

1937

The owner had operated a 320-acre farm in Traill County, North Dakota, for 15 years. Stem rust caused heavy loss in 30 acres of Ceres wheat. Eleven bushels per acre were obtained out of an expected yield of 35 bushels. The loss, estimated at $700 for that year, forced the owner to borrow money to carry on farming operations for the next few years, and created hardship in family life. It took three to four years or more to recover from the loss. Favorable crops helped in recovery. -- R. L. Nelson

1938-1945

A tenant farmer had operated a 320-acre farm, small for this region, in Box Butte County, Nebraska, for eight years. Stem rust caused severe loss in wheat; only 6 to 8 bushels were obtained of an expected 18-bushel yield. The loss amounted to $3300. Repeated poor crops prevented the operator from improving his financial standing and forced him off the farm. The family living standard was very poor. The man turned to other employment. -- J. R. Decker

1943

The owner had operated his 93-acre farm in Wood County, Texas, for 14 years. Black rot was severe in 19 acres of sweetpotatoes. The seed roots were dipped, but the soil was infested. Out of 2090 bushels stored 1650 were lost from this disease, amounting to $1650. The financial setback took about three years to overcome. The family living standard was lowered materially for at least three years. Home repairs were delayed. -- E. A. Spacek.

1943 through 1947

The owner, a good farmer, had operated his farm in East Feliciana Parish, Louisiana, for 12 years. Blight caused heavy loss in 60 acres of common lespedeza. Seventy-five percent of the stand was destroyed; of the 12 bushels expected yield 2 bushels were obtained, amounting to $60 loss per acre. Other enterprises on the farm offset the loss to some extent. The loss resulted in putting off the purchase of needed items that would improve living conditions. The farmer recovered by shifting to other crops. -- Farrell M. Roberts

1944

Anthracnose caused heavy loss on 35 acres of cotton grown on a 180-acre farm in Lawrence County, Alabama, operated by the owner for ten years. The loss amounted to $1850; 325 pounds out of 500 pounds of lint expected were obtained. It prevented the purchase of needed farm machinery and home furnishings. -- S. P. McClendon

1945 through 1948

The farmer had owned his farm in Bennington County, Vermont, for seven years. Apple scab and insects caused severe damage in his apple orchard, scab being the main cause of loss. The orchard was dusted for control, but the yield was only about 25 to 50 percent of normal. The farm orchard has not actually been lost yet but another crop failure will result in its loss. Living standards have been maintained at the expense of farm equipment and upkeep of orchard. -- Harry R. Mitiguy

1946

A tenant, a good farmer, had operated a large farm in Rockland County, New York, for three years. Late blight caused 70 percent loss in tomatoes; the average yield was 150 to 200 bushels per acre, out of 500 to 600 expected. Many fields were never harvested. The total yield loss was 30,000 bushels. Fresh markets refused green-packed tomatoes afterward. The loss amounted to $40,000. Plans to build a farm home were delayed a year and a half. A good crop in 1948 brought financial recovery. -- William J. Clark

1946, 1947, 1948

A 90-acre farm in Caroline County, Maryland, had been farmed by the owner for 19 years. Late blight caused 60 to 75 percent loss in 10 acres of tomatoes. About 1 1/2 tons were obtained of the expected 6 tons per acre; amounting to approximately $200 loss and preventing some desired repairs and the purchase of farm and home equipment. -- F. M. Rogers.

The owner, a good farmer, had operated his 145-acre farm in Wicomico County, Maryland, for 35 years. Anthracnose, leaf spot, and wilt were very destructive to 5 acres of cantaloupes, although dusts and sprays were applied for control. The loss was estimated at 95 percent; practically no yield was obtained. The farmer has not yet recovered from this loss. He grew corn, watermelons, and sweetpotatoes in 1948, but heavy rains prevented these from yielding an income of any amount and also favored anthracnose on the watermelons. If this condition keeps up, it may result in lower living standards. -- James P. Brown

1947

The farmer had owned his farm in San Joaquin County, California, for 25 years. Spotted wilt, for which there is no economic control, caused complete loss of crop in 40 acres of tomatoes; 18 tons per acre were expected, whereas no crop was obtained. At $25 per acre the expected return was $18,000; minus picking costs of $7200, the loss amounted to $10,800. The loss effected a reduction in capital and increased the amount of money borrowed to finance the next season's crops. It did not affect education or health as a profit was made on other crops raised, but did cause a reduction in things that might have been purchased to increase the standard of living. The farmer has recovered partially from this loss, but it will probably take him three or four good years to get back to where he would have been if the crop had not failed. -- Jack P. Underhill

1947 and 1948

A 20-acre farm in Essex County, Massachusetts, had been farmed by the owner for 15 years. Apple scab caused 100 percent loss for two years. The farmer applied two pre-blossom sprays. Four thousand bushels was the expected yield, but 200 bushels were obtained. The loss amounted to $4000, at least half of which was due to scab. The grower sought employment in industry after this combination of two successive poor crop seasons, due to the disease, poor pollination, etc. He had to work hard to make a living with these two short crops. He has only partially recovered his former position, by working in industry three years or more. Remarks: This is a typical case of smaller orchards during the past three years. Many have been abandoned because of crop failure and poor disease control. -- Calton O. Cartwright

The farmer had owned his farm in Rockland County, New York, for 28 years. Scab caused heavy loss in his 66-acre apple orchard. Instead of following the Extension Service spray service schedule, he planned a two-weeks' spray schedule. The loss was 85 to 90 percent: of the 8500 to 9000 bushels expected he obtained about 1000, and 40 percent of these were partly scabby. He lost a whole year's work, amounting to at least $16,000. He had to reduce his help on the farm by two men. He had planned to buy a new sprayer and duster but was able to buy a fruit duster only. He needs a new tractor badly. His wife was forced to go to work in order to assist their daughter in college. It will take at least three good fruit seasons to recover from this loss. -- William J. Clark

1947-1948-1949

The owner, a good farmer, had operated an 80-acre farm in Volusia County, Florida, for 20 years. Black rot, a disease new to the region, caused 80 percent loss in 40 acres of cabbage, although the farmer attempted to control it by spraying. Only 6 tons per acre were obtained of the expected 30 to 40 tons. The loss amounted to $3000 per acre. The farmer changed to cattle production and to other crops. Remarks: This is a sample of what happened to a dozen farmers in one area. Change of occupation and type of farming resulted. Some farmers reduced acreages and diversified. To date there have been no farm foreclosures. -- W. J. Platt, Jr.

1947-48, 1948-49

The farmer had owned his farm in Hendry County, Florida, for two years. Late blight caused complete loss in 50 acres of tomatoes, in spite of the use of Dithane. Three hundred bushels per acre was the expected yield; none at all was obtained. The loss amounted to $50,000. The farmer had to go deeper in debt to plant again. Remarks: Late blight is affecting the economy of our whole winter tomato crop each year. -- H. L. Johnson

1948

A tenant farmer had operated a farm in Greenlee County, Arizona, for one year. *Phymatotrichum* root rot caused loss of half the cotton crop on 40 acres, amounting to $160 an acre. The farmer was forced to move to another farm to make a living. Low income resulted in low living standards. The loss has not yet been overcome. -- John L. Sears

The farmer-owner, a poor farmer, had operated his farm in San Joaquin County, California, for six years. Shot hole caused 90 percent loss in a 20-acre apricot orchard. The farmer failed to apply control sprays because of sprayer breakdown. Seven tons of marketable fruit were obtained, of the 70 tons expected, amounting to more than $3000 loss. The loss of income forced the grower, his wife, and children to hire out as fruit pickers to make up the deficit. Living standards were seriously reduced, and the children's health endangered because of poor diet. The farmer has only partially recovered from this loss; recovery will take several years, if the farm is not lost. Remarks: It is very likely that this farmer may lose his land as a result of his loss. As his only possibility of earning a living is by his knowledge of farming, he will be forced to hire out as a farm laborer and likely will join the ranks of transient farm workers. -- Fred M. Charles

A tenant, a good farmer, had operated a farm in Spokane County, Washington, for three years. In spite of sulfur sprays for its control, apple scab caused complete loss in the 40-acre orchard. The loss amounted to $5000. This was a cash rent agreement, and the renter was forced to give up this farm and move to another because of lack of income. He had sufficient other income to carry him through. Remarks: Apple scab was very serious to all our apple producers last year. There was considerable economic loss to many growers. -- H. L. Axling

THE PLANT DISEASE REPORTER

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Division of Mycology and Disease Survey

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UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 187

CANTALOUP MOSAIC INVESTIGATIONS IN THE IMPERIAL VALLEY 1949

Supplement 187 December 15, 1949

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

CANTALOUP MOSAIC INVESTIGATIONS IN THE IMPERIAL VALLEY, 1949.

Plant Disease Reporter
Supplement 187

December 15, 1949

FOREWORD

The following articles report findings of the past season of a joint project set up to study the cantaloup mosaic disease in the Imperial Valley of California by staff members of the University of California and the U. S. Department of Agriculture in cooperation with the Imperial Valley Pest Control Committee. The present work is a continuation of that reported in the Plant Disease Reporter, Supplement 180, January 1949. A summary of the current status of the problem is included.

CONTENTS

VECTOR STUDIES

R. C. Dickson

Aphid populations in the Imperial Valley were much lower in 1949 than in 1948. The sticky-board traps caught only 18.1 percent as many aphids in 1949 as in the previous year, and the actual difference was probably greater between the two years. There was a considerable aphid population in the Valley, however, even in 1949; and the aphids acting as vectors of cantaloup mosaic were the same transient type of population observed the previous year. Aphids did not breed on the melon plants in any appreciable numbers. They came from other crops and from weeds and flew through the melon fields in their search for host plants. Each aphid fed for only short periods on a succession of melon plants. Although attracted enough to land on them, the insect did not find these plants to be suitable food, and moved on after a 40-second sampling. Fifty-two and a half percent of the aphids caught were the green peach aphid, Myzus persicae (Sulz.), which breeds chiefly on sugar beet in this area.

The lower aphid population during the 1949 season was reflected in greatly decreased mosaic damage. The infection percentage in melon plants was much lower than in 1948, and most of the plants that were infected remained healthy until the crop was practically mature. For the Valley as a whole, less than 40 percent of the melon plants contracted mosaic during the 1949 season, in contrast to practically 100 percent infection the previous year.

The lower 1949 aphid population also caused the mosaic to spread more slowly so that in most fields those plants that did become infected had already set and almost matured their melons. Late infections of this type do almost no damage. A few late-planted fields were seriously damaged by the disease.

Attempts to reduce damage from cantaloup mosaic by the use of aphid repellents confirmed the results of the previous season that no known aphid-repellent substance is efficient enough to be practical. Some new insect repellents were tried but tetramethyl thiuramdisulfide was still the only material to have any protecting effect. Tests with this material on a larger scale than in 1948 served to confirm the belief that it is not good enough for a practical control.

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THE OCCURRENCE, DISTRIBUTION, AND SOURCES OF THE CANTALOUP MOSAIC VIRUSES IN 1949

John T. Middleton

Investigations upon the cantaloup mosaic problem during the past growing season were directed towards ascertaining the kinds of cucumber viruses present, their distribution, and some of their sources.

One hundred seventy-nine samples of infected plant material were collected from 53 sampling areas in both the Palo Verde and Imperial Valleys at regular intervals, commencing with the first appearance of the disease on May 9 and concluding on June 13, 1949. Viruses were secured from cantaloup, cucumber, Honeyball melon, Honeydew, Persian melon, squash (Banana and summer types), and watermelon. Inoculations were made with juice extracts, using the carborundum-cotton pad technique, upon a variety of selected hosts. The hosts *Cucurbita pepo* Duch., *Citrullus vulgaris* Schrad., and *Vigna sinesis* Endl. permitted the separation of the viruses into three groups: cucumber virus 1 caused symptoms in all 3 hosts; an undescribed cucumber virus caused symptoms only in squash; squash-mosaic virus caused symptoms only in squash and watermelon. All 3 viruses caused similar symptoms in cantaloup.

Table 1. The occurrence of cucumber virus 1, undescribed cucumber virus, and squash-mosaic virus on cultivated cucurbits in the Palo Verde and Imperial Valleys of California.

Host	Number of Collections	Frequency of viruses recovered		
		Cucumber 1	Undescribed cucumber	Squash-mosaic
Cantaloup	139	6	9	124
Cucumber	3	0	0	3
Honeyball	8	0	0	8
Honeydew	3	0	3	0
Persian	7	0	1	6
Squash	6	0	0	6
Watermelon	13	0	0	13
Total	179	6	13	160

Apparently the squash-mosaic virus is the most common virus present, followed by the undescribed cucumber virus, and cucumber virus 1 (Table 1). The squash-mosaic virus and the undescribed cucumber virus were found in both the Palo Verde and Imperial Valleys, while cucumber virus 1 was found only in the Imperial Valley. The relative distribution of these viruses may be expected to vary from year to year, but it would seem apparent that the squash-mosaic virus may remain predominant.

A variety of wild plant material, including native as well as introduced weed plants, was collected that exhibited foliar virus symptoms. Although these studies are incomplete, it may be of interest to report here that both the cucumber virus 1 and squash-mosaic virus have been recovered. Cucumber virus 1 has been secured from: Amaranthus spp., Chenopodium spp., Datura meteloides De., Daucus carota L., Lactuca serriola L., Physalis spp., and Solanum spp. The squash-mosaic virus was secured from Cucurbita foetidissima HBK. and C. palmata Wats.

Previous studies indicate that commercial squash plantings are the principal sources of the squash-mosaic virus. Not only is the virus present in squash during the winter and early spring months preceding melon culture, but the virus may be introduced into both squash and melon plantings through planting of viruliferous seed. Likewise, the undescribed virus may be introduced into melon plantings by means of virus-infected seed. It is, therefore, not surprising to find these viruses generally distributed throughout the melon-growing area and perpetuated by means of both susceptible native host plants and contaminated seed stocks.

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MOSAIC REACTIONS OF POWDERY MILDEW RESISTANT LINES OF THE MUSKMELON

G. W. Bohn and Thomas W. Whitaker

The mosaic reactions of 12 inbred lines of powdery mildew resistant cantaloups were compared with those of 3 commercial varieties in randomized plantings at the U. S. Department of Agriculture, Southwestern Irrigation Station, Brawley, California, during the 1948-1949 season. Four replications were planted on each of 3 planting dates, December 14, January 3, and February 10. Other muskmelon lines served as buffers on all sides of the replicated plantings. Each planting occupied 225 foot portions of 8 plant beds. Each block required 2 adjacent beds and consisted of 1 plot of each variety or line. Each plot consisted of 20 plants in adjacent 10-plant subplots in the 2 beds. The plants were arranged in pairs ("hills") 18 inches apart. Two of the plantings were destroyed by inclement weather, leaving the single late planting of 4 replications for analysis.

Planting, thinning, cultivating, and irrigating operations were essentially those used by commercial growers in the Imperial Valley. The plants were covered with waxed paper caps (the east ends opened after emergence) until April 4.

Natural infection by aphid-transmitted viruses occurred later than in preceding years and progressed more slowly. Most of the plants had half-grown fruits at the time of infection. The plots were rated for symptoms of mosaic on four dates from May 17 to June 16, following the appearance of symptoms in all of the plants. The ratings on adjacent subplots were assigned by two judges and combined for analysis. An arbitrary numerical scale was used to rate each subplot as a whole. The mosaic rating classes and the symptoms they indicated are shown below.

Class	Leaf chlorosis	Leaf distortion and size reduction	Plant vigor
4.0	mild	trace	excellent
3.5	moderate	slight	good
3.0	severe	moderate	moderate
2.5	severe	severe	poor
2.0	severe	very severe	very poor

Records were kept, also, of the weights and numbers of ripe marketable fruits, culls, and of 15 fruit characters important to growers, shippers, and consumers. These data will be mentioned only as they are related to the problem of mosaic resistance.

Table 1. Analysis of variance of data on the severity of mosaic symptoms in varieties and selected inbred lines of muskmelons grown in Brawley, California, 1949. Natural infection, 100%. Four readings at intervals of 8 to 12 days. Adjacent beds in two-bed (20 plant) plots scored by two judges. Half-plots (10 plants) scored in arbitrarily selected severity classes.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F [a]	E_{diff}	t at 5%	Sig. Diff.
Varieties	14	47.685417	3.406101	53.69**	0.089	1.98	0.18
Dates	3	7.743228	2.581076	40.68**	0.046	1.98	0.09
Replications	3	0.651562	0.217187	3.42*			
Var. x dates	42	4.577084	0.108978	1.72*			
Var. x Repl.	42	8.543750	0.203423	3.21**			
Dates x Repl.	9	1.592189	0.176910	2.79**			
Error	126	7.993749	0.063442				
Total	239	78.786979					

[a] F values marked with one asterisk (*) are significant at the 5% point; those marked with two asterisks (**) are significant at the 1% point.

Analyses of variance of data from each judging date and the combined data from all dates (Table 1) indicated relatively large and very significant[1] differences in the reactions of different varieties (and lines) and in symptom expression in the entire planting on different dates. The variation among replications was nonsignificant. Small, but very significant variation resulted from the interaction between varieties and replications and from the interaction between dates and replications. The variation resulting from the interaction between varieties and dates was barely significant.

A slight increase in the severity of symptoms during May and early June, and an increase in the vigor of growth of most of the varieties thereafter was reflected in the very significantly different means for dates.

[1] Variation at odds of 19 to 1 is termed significant; variation at odds of 99 to 1 is termed very significant.

Most of the variation causing significance in the interaction between varieties and replications occurred within 3 of the inbred lines; other lines and varieties had relatively uniform ratings in all replications. The small but very significant variation in this interaction may have resulted from local position effects, or it may indicate that these 3 lines were more sensitive to differences in the environment than were the other lines.

The small but very significant variation that resulted from the interaction between dates and replications, together with the nonsignificant variation among replications, indicated that the disease symptoms were most severe in different replications on different dates. Such differences could result from different stages of progress of the disease in the different replications or from changes in environmental factors in the different replications at different times of the season.

The barely significant variation resulting from the interaction between varieties and dates was of particular interest because each of these variables alone caused great variation. This small interaction indicated the marked agreement of the relative ratings of the different varieties throughout the season.

The data indicated that the differences observed among the lines and varieties were real differences in the severity and duration of mosaic symptoms under the conditions of the experiment, and were little affected by the time of infection and progress of the disease. Together with the data on fruit yields they suggested that the severity of symptom expression was independent of the time of maturity and amount of fruit production. These are very important considerations in utilizing this type of mosaic tolerance in commercial muskmelon production. Whether these differences were differences in mosaic tolerance _per se_ or differences in vigor and/or water or nutrient requirements remains to be determined.

The means of the variety ratings on different dates and the grand variety means are shown in Table 2. Tukey's[2] procedure for comparing means separated the varieties and inbred lines into 3 groups. Group 1 included 8 inbred lines with a grand mean mosaic index of 3.01. These inbred lines developed only moderate symptoms of mosaic and continued to grow vigorously. Group 2 included the single variety Sulfur Resistant V-1 with a mean mosaic index of 2.64. This variety developed severe symptoms of mosaic but continued to grow with moderate vigor. Group 3 included 4 inbred lines and the varieties Powdery Mildew Resistant Cantaloup Number 5 and Powdery Mildew Resistant Cantaloup Number 6, with a mean mosaic index of 2.38. These lines and varieties developed very severe symptoms of mosaic and grew with little vigor following

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[2] Tukey, J. W. Comparing individual means in the analysis of variance. Biometrics 5: 99-114. 1949.

Table 2. Severity of mosaic symptoms in varieties and inbred lines of muskmelons at Brawley, California, 1949.

Variety or line	Date rated May 17	May 25	June 6	June 16	Grand means[a]	Group
	variety mean ratings					
34574	3.19	3.00	2.94	3.25	3.09	1
34663	2.94	2.94	3.00	3.50	3.09	1
34619	2.94	3.25	2.94	3.13	3.06	1
34622	2.94	3.06	2.88	3.48	3.06	1
34661	2.75	3.06	3.00	3.48	3.05	1
33952	3.00	2.94	2.94	3.25	3.03	1
34610	2.75	2.81	2.81	3.06	2.86	1
34575	2.75	2.69	2.88	3.13	2.86	1
Sulfur-resistant V-1	2.63	2.56	2.56	2.81	2.64	2
34030	2.50	2.44	2.31	2.81	2.52	3
Powdery Mildew Resistant No. 6	2.50	2.44	2.38	2.56	2.47	3
34003	2.50	2.31	2.19	2.50	2.38	3
34145	2.38	2.38	2.19	2.50	2.36	3
Powdery Mildew Resistant No. 5	2.56	2.31	2.06	2.44	2.34	3
24102	2.31	2.13	2.00	2.50	2.23	3
Date means	2.71	2.69	2.60	2.95	2.74	

[a] The least significant difference between grand means of varieties at odds of 19 to 1 equals 0.18.

infection.

Unfortunately, none of the 8 inbred lines with superior mosaic tolerance was considered suitable for commercial muskmelon production. Although these lines were equally as good as (or occasionally superior to) the commercial varieties in most of the important economic characters, each line lacked at least one character essential for an economic passport. These lines did possess many characters that indicate their value as parental stocks in the breeding program. The data obtained in this experiment suggested that the mosaic tolerance occurring in these lines has a potential economic value.

U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY, SOILS & AGRICULTURAL ENGINEERING
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CANTALOUP MOSAIC, AS AFFECTED BY NITROGEN FERTILIZATION

F. W. Zink and G. N. Davis

Observations in commercial plantings by other investigators have indicated that satisfactory yields of melons could be obtained despite the presence of cantaloup mosaic virus, if the crop was carefully handled as to irrigation and fertilization to stimulate vigorous growth. The more common fertilizer regimes for cantaloups in the Imperial Valley include the application of 300 lb. per acre of super phosphate, broadcast before making the plant beds or, more commonly, banded in the row at planting or thinning. Nitrogen fertilizers are applied on other crops in the rotation but are usually omitted from the fertilizers applied during the growth of cantaloups. Occasionally, 60 pounds of nitrogen, as ammonium nitrate or ammonium sulfate, per acre are applied as side dressings after emergence of the cantaloups. The purpose of the study was to determine:

1. Whether the application of nitrogen fertilizer above the normal amounts through the growing season would alleviate the severity of the disease.
2. Whether such application of nitrogen would delay the maturity of the fruit.
3. Whether such application would affect the sugar content of the fruit.

Procedure

Four test areas were selected in different localities in the Imperial Valley. Each test area was planted to a different variety as shown below.

Test Area I.	Powdery Mildew Resistant Cantaloup No. 5 at the Meloland Station.
Test Area II.	Powdery Mildew Resistant Cantaloup No. 45 at the N. J. Vanoni Ranch, west of El Centro.
Test Area III.	Growers Selection K-1 at the S. A. Gerrard Ranch, north of Brawley.
Test Area IV.	Powdery Mildew Resistant Cantaloup No. 6 at the Western Fruit Growers Ranch, Tamarack District.

Four treatments were applied to each test area as follows:

1. 60 pounds of nitrogen per acre was applied 2 to 3 weeks after planting (check).

2. 60 pounds of nitrogen per acre was split into four applications and applied at intervals through the growing season.
3. 120 pounds of nitrogen per acre was split into four applications and applied at intervals through the growing season.
4. 180 pounds of nitrogen per acre was split into four applications and applied at intervals through the growing season.

The nitrogen (ammonium nitrate) was drilled to a depth of 1 inch along the side of the furrow approximately 8 inches from the plants. All treatments received 80 pounds of P_2O_5 per acre three to four weeks after planting. This phosphate (triple superphosphate) was drilled in to a depth of 7 inches along the side of the furrow and approximately 6 inches from the plants. Each treatment consisted of two 300 foot beds; an area of approximately 1/11.1 of an acre. Records were taken of vine condition and severity of virus infection. Yield data from each harvest consisted of the number of marketable fruit, weight of marketable fruit, number of cull fruit, and weight of cull fruit. Five cantaloups were selected at random from each treatment on four consecutive harvests, and refractometer readings were taken of these melons to determine percentage of soluble solids.

Observations

Mosaic appeared in Test Area I on April 21, and by the 5th of May the field was approximately 100 percent infected. Compared with the other treatments, plants in treatment 1 were more vigorous throughout the season and produced fewer shoots with stunted leaves. Symptoms on plants in treatment 1 were limited to distortion of leaf margins and moderate chlorosis of leaves. Treatments 2, 3, and 4 recovered from stunted leaf growth and appeared to be quite vigorous at harvest.

Symptoms of mosaic were first noticed in Test Area II on May 3 and by May 14 it was approximately 100 percent infected. Plants in treatments 2, 3, and 4 appeared to be more vigorous than in treatment 1. Virus symptoms in this test area were limited to distortion of leaf margins and moderate chlorosis. The field was severely infected with powdery mildew. This disease reduced the yield considerably.

Test Area III showed the most severe symptoms of the disease. Mosaic was observed first on May 6, and at that time the plot was approximately 100 percent infected. Treatments 3 and 4 had considerably better vine growth than treatments 1 and 2 at harvest. By June 10 treatments 1, 2, and 3 showed severe chlorosis and severe distortion of leaf margins. Treatment 4 continued to look vigorous until the end of the harvest period.

Table 1. Summary of harvest records for 1949 cantaloup mosaic study. Yield per acre was recorded in Jumbo 36 crates; mean weight of fruit, in pounds.

Treatment	Crates Per Acre	Mean Weight Marketable Fruits	Mean Weight Cull Fruits	Percent of Fruit culled
		Test Area I		
1	171.5	2.44	1.1	28.8
2	132.6	2.60	1.6	21.9
3	143.3	2.75	1.6	32.7
4	134.8	2.76	1.5	39.3
		Test Area II		
1	80.5	2.48	1.30	19.7
2	113.0	2.36	1.77	17.7
3	97.8	2.31	1.63	20.8
4	103.2	2.39	1.71	11.6
		Test Area III		
1	96.6	2.39	1.66	48.3
2	99.1	2.35	1.63	40.8
3	99.4	2.34	1.65	37.4
4	63.3	2.46	1.62	38.5
		Test Area IV		
1	171.4	2.61	1.90	34.7
2	180.0	2.66	1.79	35.4
3	183.0	2.75	1.80	38.3
4	181.9	2.67	1.88	38.2

Test Area IV showed the least injury from the disease. Symptoms of mosaic in this field were first noticed on May 10, and by May 15 infection was approximately 100 percent. Symptoms were limited to mild chlorotic mottling. In this area there appeared to be no differences between treatments in regard to disease symptoms or in growth of vines.

Results

Analysis of harvest records (Table 1) indicates that the severity of the cantaloup mosaic disease as reflected in yield was not alleviated by use of nitrogen fertilizer. In none of the test areas did treatments 3 or 4 increase yield sufficiently to warrant heavy applications of nitrogen.

All treatments for any one given test area seemed to mature fruit at the same rate and to reach peak production at approximately the same date. There appeared to be no delay in maturity of fruit as a result of nitrogen application.

Analysis of variance for total soluble solids content of the fruits indicated that there was no significant difference between treatments in any of the test areas. Therefore, nitrogen fertilization at the rates applied did not have any effect on soluble solids content of fruit.

When this study was undertaken there appeared to be some evidence to suggest that satisfactory yields could be obtained in a virus-infected field if proper horticultural practices were followed. The results of this year's investigation indicate that the severity of the mosaic disease as reflected by plant symptoms and yields was not alleviated by the use of nitrogen fertilizer.

Acknowledgment

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PRESENT STATUS OF CANTALOUP MOSAIC IN THE IMPERIAL VALLEY

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F. W. Zink, and G. N. Davis

The cantaloup mosaic investigations in the Imperial Valley have produced some useful, fundamental information upon which the successful control of the disease may ultimately be based. It seems desirable to summarize the status of our present knowledge of the disease.

At least three viruses occur on muskmelons in the Imperial Valley. These three viruses can be identified by their effects, or lack of effects, upon the three differential hosts Cucurbita pepo L., Citrullus vulgaris Schrad., and Vigna sinensis Endl. The three viruses produce similar symptoms on Cucumis melo L. The squash-mosaic virus predominated in 1949 collections, but the relative importance of the different viruses may be expected to vary from year to year.

Sources of the viruses include muskmelon and squash seed, cultivated squashes, and several introduced and native weed species. A permanent reservoir of the virus is probably established in the wild (some of them perennial) and cultivated plants growing in the area.

The disease is carried to the muskmelon fields and spread within the fields principally by aphids. The species involved do not prefer muskmelons as host plants but pause briefly to feed upon them during their migratory search for a more suitable food supply. The habit of feeding briefly on numerous individual plants, including muskmelons and many related and unrelated species, during the migration is a major factor in the disease problem. It contributes to the extreme efficiency of these insects in transmitting the viruses and to the lack of effectiveness of insecticides in controlling the disease.

The predominant species of aphid in the area is the green peach aphid, Myzus persicae (Sulz.). This species is a proven vector of the three known viruses and is presumably the main vector of the cantaloup-infecting viruses in the area. It breeds chiefly on sugar beets in the Imperial Valley, migrating in enormous numbers in March and April in a search for additional host plants. The sugar beet apparently does not harbor the viruses.

The increasing prevalence of mosaic in muskmelons in the Imperial Valley has been correlated with the increasing area devoted to sugar beets. During the past two seasons the prevalence and rate of spread of mosaic in muskmelons has been correlated with the numbers of aphids involved in the spring migrations.

Tests with numerous insecticides indicate that mosaic cannot be controlled through the application of insecticides in the muskmelon fields. The effects of premigration insecticide applications in the beet fields and elsewhere have not been studied sufficiently to permit estimates of possible value or recommendations for their use.

Tests of more than 600 accessions of Cucumis, mostly from Asia, have yielded some stocks with moderate degrees of resistance or tolerance to one or more of the viruses, but neither immunity nor extreme resistance has been found. Some of these stocks are being used in the breeding program in the effort to combine greater tolerance to mosaic with resistance to powdery mildew and the several other economic characters required in a shipping variety suitable for culture in the Imperial Valley.

Less marked degrees of variation were found in the inbred lines of powdery mildew resistant cantaloups than in the foreign plant accessions. A single year's results indicated that certain lines were more tolerant of mosaic than were the commercial varieties now in use. Further work will be required to incorporate into single lines all of the characters required for successful commercial production.

Observations on commercial fields suggested that some cultural practice or practices may affect the response of muskmelons to mosaic. A single year's results with nitrogen fertilizer indicated that applications of this nutrient above normal usage did not increase or decrease mosaic symptoms, vine vigor, yields, or soluble solids in naturally infected fields. The effects of other nutrients and irrigation practices remain to be studied.

UNIVERSITY OF CALIFORNIA AND THE U. S. DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE IMPERIAL VALLEY PEST CONTROL COMMITTEE

THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
AGRICULTURAL RESEARCH ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 188

THE PLANT DISEASE WARNING SERVICE IN 1949

Supplement 188 December 15, 1949

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

Issued by

THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

THE PLANT DISEASE WARNING SERVICE IN 1949

Paul R. Miller and Muriel O'Brien

Plant Disease Reporter
Supplement 188 December 15, 1949

One of the interesting characteristics of plant diseases in general is their great degree of fluctuation from year to year in their occurrence, prevalence, and destructiveness. The diseases that we have under consideration in the Crop Plant Disease Forecasting Project seem to be no exception. These diseases, late blight of potato and tomato (Phytophthora infestans), blue mold of tobacco (Peronospora tabacina), and downy mildew of cucurbits (Pseudoperonospora cubensis), were as widely distributed in 1949 as in the past three years but generally not as destructive. Figures 1 through 4 plot this year's distribution of these diseases and our short text will attempt to tell the highlights of the second year's observations under the Warning Service.

Phytophthora infestans on Potato:

Infection on potatoes with P. infestans, although reported from the numerous places shown in Figure 1, was of little economic importance this year. Sources of infection included cull piles, seed potatoes, the overwintering refuse resulting in infected volunteer plants, diseased seed, infected tubers, and airborne spores which produced scatter infection. Attack usually took place at from early maturity to full maturity, with infection local to general in occurrence and slight to moderate in effect. At the time of first appearance in the field estimated percentages of infection ranged from 5 to 100. At time of continued spread estimated percentage of infection ranged from a trace to 100, with losses ranging from a trace through slight to a high of 25 to 50 percent.

Weather reports from the various States show that, for the most part, rainfall was light, dews present, and temperature near normal to above normal prior to appearance of the disease, although several States reported heavy rainfall before attack, with temperatures ranging from much below to near normal. The warm wet and warm dry conditions prevailing this summer over the eastern to northeastern portion of the United States

(Fig. 5), probably because of the higher temperatures, prevented the production and dissemination of spores of the fungus.

Fungicides used as sprays included Dithane, Parzate, tribasic coppers, Bordeaux, fixed coppers (Basicop, Perenox), and Dithane and Parzate plus zinc sulfate. All fungicides gave good control when applied properly with adequate coverage. Five States, eastern Ontario, and Quebec reported that Bordeaux was used successfully by from 10 to 50 percent of the growers with good to excellent results. Dusts employed on potato were neutral copper, commercial dusts containing Dithane Z-78 and Parzate, Copper A, and zinc carbamate, with good results obtained. One report listed poor results from the use of yellow copper oxide and copper lime. A schedule of Fungicide Results is given in Tables 1 and 2.

Phytophthora infestans on Tomato:

Tomato late blight likewise was unimportant nationally this year, although reported as severe by growers in several areas. Sources of inoculum were southern plants, carry-over on potatoes, infected potatoes in nearby fields, and scattered infections which suggested airborne spores. Plants were attacked when at young transplant stage, one-half maturity size, at maturity, and at late fruit set. Infection for the most part was reported as general or local, with a few reports of scattered infection. Severe damage was reported at Leesburg, Florida in May. In the Virginia mountain area, also, damage was severe at the time of continued spread of the disease, when there were some large fruits on the plants. Infection in Mississippi was general during the three stages (first appearance, continued spread, and reappearance), with severe damage at first cluster open, and severe to moderate damage on green mature fruit.

Estimated percentage of infection in fields ranged from a trace to 20 at time of first appearance, with higher ranges of 50 to 100 reported in areas more heavily affected. At time of continued spread the range was as wide, i. e., from a trace to 100 percent, the most notable circumstance being the low infection in sprayed fields, which sometimes amounted to only 5 to 10 percent as against 90 to 100 percent in unsprayed fields. Similarly, reduction in yield followed the same pattern, with slight reductions in sprayed fields and as high as 50 percent in unsprayed fields. One State reported up to 100 percent reduction in yield, but no evidence was given as to whether the fields had been sprayed. In Mississippi, although area planted to tomatoes this year was estimated to be 1500 acres more than in 1948, the yield was less by 200 carloads. Part of this reduction was due to stem-end cracking of the fruit brought about by excess rainfall prior to picking, part to buckeye rot (Phytophthora parasitica Dast.), while late blight fruit rot was said to be responsible for 30 percent of the total reduction.

Fig. 1 · DISTRIBUTION of TOMATO LATE BLIGHT in 1949

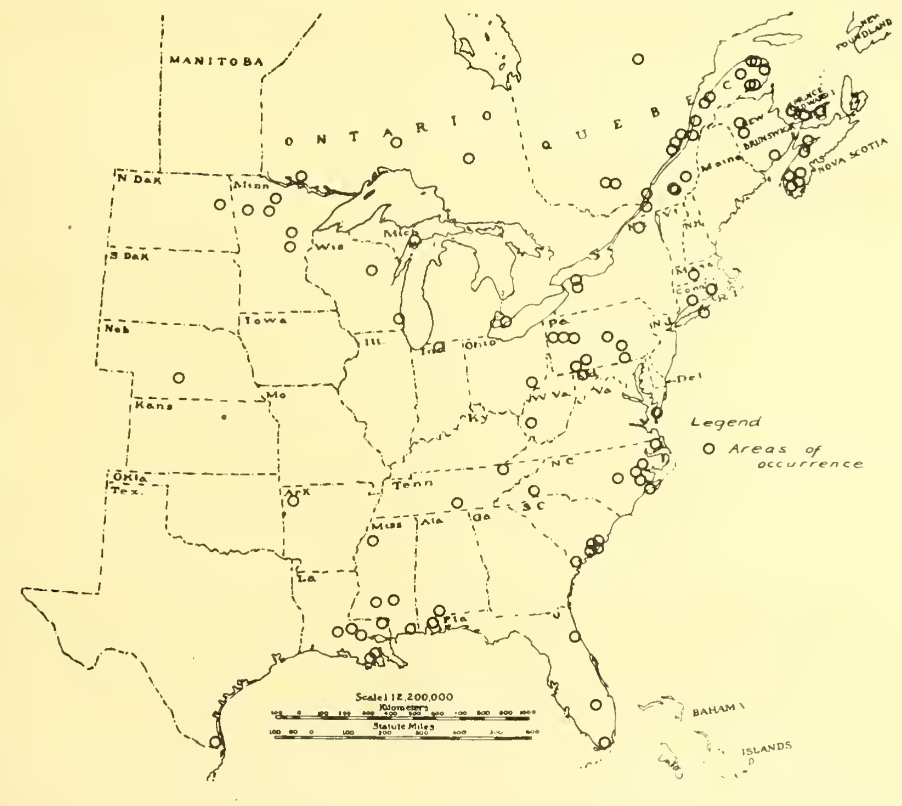

Fig. 2 · DISTRIBUTION of POTATO LATE BLIGHT in 1949

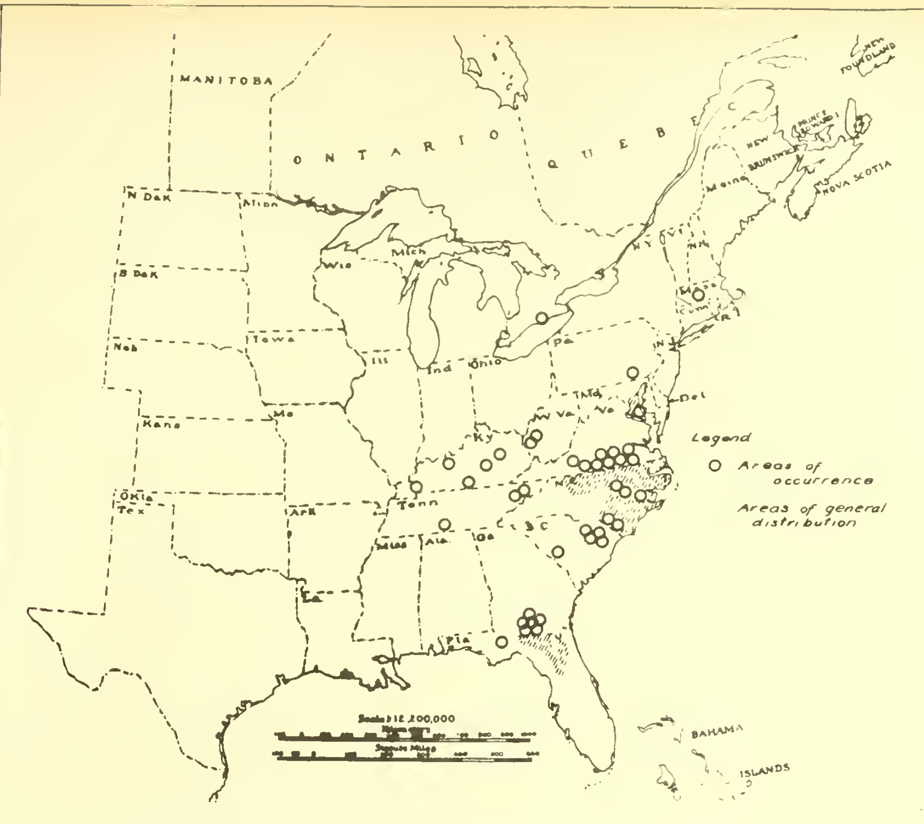

Fig. 3 DISTRIBUTION of TOBACCO BLUE MOLD in 1949

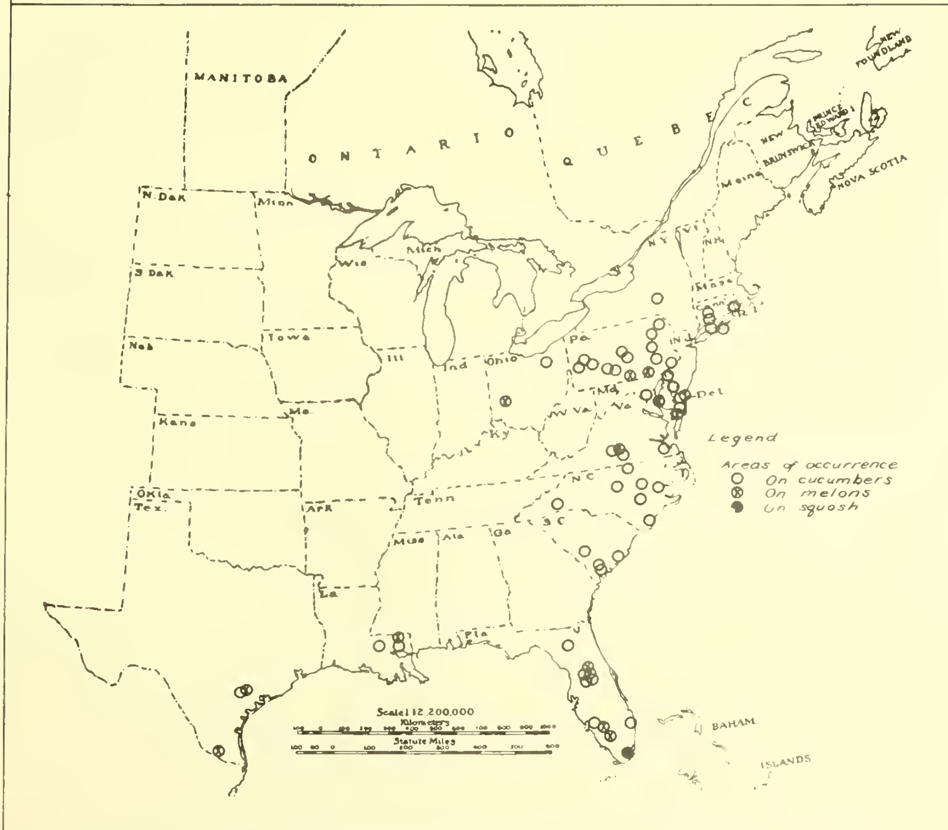

Fig. 4 - DISTRIBUTION of CUCURBIT DOWNY MILDEW in 1949

Rainfall, as affecting tomato late blight this year, was reported rather consistently as being light to moderate, although heavy rainfall was reported in Virginia, Arkansas, Mississippi, Illinois, Pennsylvania, Michigan, and Ontario, Canada, at the time of appearance and spread. In Maryland rainfall was heavy at the time of appearance. Temperatures reported were near normal to above normal. Dews were reported present in the greater majority of cases.

Reports indicated that the increased use of fungicides for control of late blight on tomato, together with the dry summer, probably contributed to the low incidence of the disease. The materials used and their effectiveness in controlling tomato late blight will be found in Tables 1 and 2.

Peronospora tabacina on Tobacco:

The distribution of tobacco blue mold in 1949 is shown in Figure 3. The types of tobacco affected were flue-cured, burley, cigar-wrapper, Havana seed, broadleaf, and shade types. Sources of inoculum were either unknown or reported as old bed-sites. Infection was reported as scattered to local, with general infection noted over the eastern half of North Carolina. Damage was slight except for the Carolinas and Virginia, which experienced a severe blue mold year.

Rainfall was reported for the most part as moderate, above normal in a few cases, with temperatures near normal to above in all reported cases. Estimated percentage of infection ranged from 1 to 100. Reduction in plants in beds was slight, with an estimated high of 10 percent. However, in several cases 100 percent reduction was reported in plant-bed yields, particularly in unsprayed beds.

Where control measures were employed soon enough excellent results were obtained. In South Carolina stunting of plants was induced when the grower used Fermate dusts with Kaolin diluent. No stunting was experienced with Fermate-Pyrophyllite mixtures and no injury was noted to plants.

Psuedoperonospora cubensis on Cucurbits:

Downy mildew of cucurbits is shown in Figure 4 as being, for the most part, present over the eastern coastline States. Acreages involved averaged about 1000 for Pennsylvania and Louisiana, and ranged from 1000 to 5000 in Delaware and Maryland. Sources of inoculum were either unknown, or reported as older plants, spring crop and garden plants, and for northern regions spread from plantings of cucurbits in more southerly regions. In Florida the organism is endemic and wild cucurbits might possibly constitute an additional source of inoculum. Infection occurred from first fruit-set to maturity, with marked activity at time of harvest; it was reported as local in Connecticut, local to general in New York, and general in Pennsylvania, Florida, Virginia, Louisiana, South Carolina, Maryland, and Delaware. Damage at start was slight. During the time of continued spread it was generally described as moderate, but severe damage was reported in Connecticut, Virginia, Louisiana, South Carolina, Arkansas, and Maryland. Estimated percentage of infection ranged from a trace to 1 at time of first appearance, to 100 at time of continued spread and at harvest. Reduction in yield was reported as trace or none to 75 percent.

Weather conditions accompanying infection were consistently reported as light rainfall prior to appearance of the disease, with moderate rainfall during period of greatest attack and spread. Dews were universally reported. Heavy rainfall occurred at time of greatest attack in South Carolina and Louisiana, and in Ontario, Canada. Temperature in most cases reported was near normal to above normal, with below normal reported from South Carolina, Arkansas, and Ontario.

The most notable event connected with occurrence of downy mildew of cucurbits this year was the loss of the cantaloup crop in South Carolina. Acreage is extensive in this State, while dusting and spraying for control have not been accepted by the vast majority. All of the loss in reduced financial returns and reduced yield in this crop this year can be attributed to downy mildew, which was reported in the worst epidemic form in this State since 1938. Downy mildew was severe on cucumbers also in South Carolina, killing almost 100 percent of the vines in ten days to two weeks after its first appearance.

<u>Phytophthora phaseoli on Lima Beans</u>:

A few reports were received on the incidence of downy mildew of lima bean (<u>Phytophthora phaseoli</u> Thaxt.) Areas of infection included southern New Jersey, south-central and southeast Pennsylvania, Long Island, New York, and Sussex and Kent Counties in Delaware. Source of inoculum is unknown. Infection was local in Pennsylvania and New York, and local to general in Delaware and New Jersey. Estimated percentage of infection in fields ranged from 5 through 55, with as high as 80 percent infection noted on pods on individual plants in localized areas of some fields. Weather conditions at time of infection and spread were indicated as moderate rainfall with temperatures above normal. Serious losses were reported in New Jersey; reduction in yield in other areas was estimated at none to 40 percent. Copper sprays, either Bordeaux or fixed coppers, and copper dust were used. No control results were given.

<u>Conclusions</u>:

Although it is impossible to measure accurately the disease potential from year to year, it would appear from the reports this year that the coordinated efforts on the part of warning service participants are paying good dividends in disease control. Indications are that control

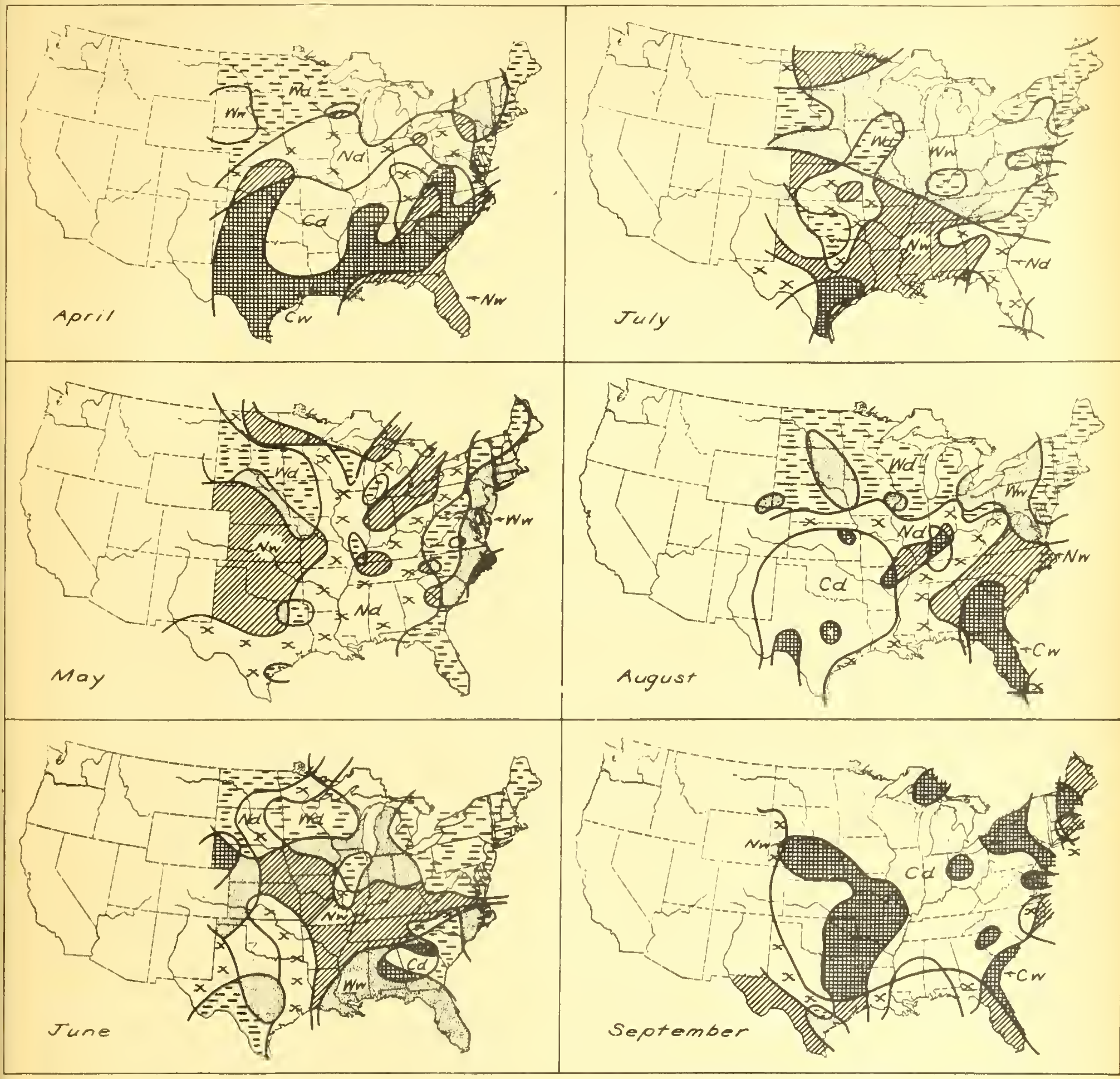

Fig. 5 MONTHLY WEATHER CONDITIONS - April through September 1949

Unshaded	Temperature and precipitation below normal	Cd
[open pattern]	Temperature and precipitation above normal	Ww
[dashed pattern]	Temperature above, precipitation below normal	Wd
[hatched pattern]	Temperature normal, precipitation above normal	Nw
[cross-hatched pattern]	Temperature below, precipitation above normal	Cw
X	Temperature normal, precipitation below normal	Nd

measures were more effectively practiced this year, particularly for tomato late blight and cucurbit downy mildew. The use of blue mold control measures still appears to be governed by the gambling chance that the attack will be light, will come at a time inopportune for fungus growth, or will not appear at all. Tables 1 and 2 summarize all control information received this year.

WORK PERFORMED COOPERATIVELY BY THE CROP PLANT DISEASE FORECASTING PROJECT AND THE PLANT DISEASE SURVEY UNDER THE PROVISIONS OF THE RESEARCH AND MARKETING ACT OF 1946

Table 1. Materials used as sprays and their effectiveness in 1949.

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by: Ground Machine	Percent Applied by: Airplane	Results and Remarks
CONTROL OF LATE BLIGHT ON POTATO									
Bordeaux	5	1	1	2	8-8-100 (2)[b]	48,10	All (2)		Excellent
					10-5-100	25	"		Good
					8-16-16	10	100		Excellent
					4-2-40	25-30	100		Good
					4-4-40	50	100		Excellent
					100-125 gal./ acre - 10 day intervals		All		?
					4-4-50	5	All		Excellent
					8-4-100 Fixed copper- 4 lbs. of 50%	50	100		Good
Fixed Coppers		1	1	2	COC-S		All		Poor
						Approx. 2	All		Good
					1%	10			Good
									One State-no result listed
Basicop				1	COC-S	Approx. 2	All		Good
Perenox				1	" "	Approx. 5	All		Good
Neutral Coppers	2		1		2 lbs./100 gal.(1)	15	All		Excellent
					4 lbs./100 gal.(1)		"		Good
						20	"		Good

For explanation of a and b and abbreviations, see footnote at end of Table II, page 314.

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Air-plane	Results and Remarks
POTATO (continued)									
Copper Zinc Chromate			1				All		?
Dithane Liq.	1		2	1	2 qts./100 gal. (1)		100		Good
					2-3 qt./100 gal. (1)	45	All		Good
					100-125 gal./acre-10 day intervals		All		?
Dithane Dry	1				1 1/2 /100	4	All		Good
Dithane D-14+ Zn SO_4	1	2			2 qt.- 1 lb./100 gal. (1)	95	100		Excellent
					2 qt./100 gal. (1)	20	100		Good
Dithane						2			Good
Biscarbamates Dithane + Parzate	1				2 qts. + 1 lb. Zinc Sulphate	23	100		Fairly good
Biscarbamates early + copper late in season	1					25	100		Good
Parzate Liq.	1				2-3 qts./100	45	All		Good
Parzate Dry	1		2		1 1/2 lbs./100 gals. (2)	$4^{(1)}$	100		Good
							100		Good
					100-125 gals./acre-10 day intervals		All		?

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
POTATO (continued)									
Parzate + Zn SO_4	1				2 qt. 3/4 lb./100	5	100		Excellent
Parzate (some results given under Biscarbamates: See above)									
CONTROL OF LATE BLIGHT ON TOMATO:									
Bordeaux (included in other sprays: See under Fixed Copper, Zerlate.)	1								
Bordeaux	1		1		4-4-100/8-8-100 8-8-100	15	All		Good Used after infection started. Control good except where fruit was badly cracked.
	1	1	1		8-6-100	10	100		Good
					5-5-50	50	100		Good
					3-4-50	5			Excellent
Compound A	1	1			2/100 gal.	3	100		Good
					4/100 gal.	?	All		Clear-cut results obscured because of dry spell three-fourths of May
Fixed Coppers (included in other sprays; see under Zerlate)	1								

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
TOMATO (continued)									
Fixed Copper	3	1			tank mix - 2 lbs. of 50% Fixed Copper + 1 lb. Zerlate in all or most sprays	3	100		Good
					4 lbs. 50% Cu./ acre or Bordo 3-6-100	9	100		Good
					2 lb. actual/100 gal.	75	99.5		Excellent
					1% Cu	10			Good
Copper		1			2/100 gal.	10	100		When spray started on time and repeated once each week and after each rain very good results obtained
Neutral Coppers	1					20	All		Good
Tribasic Copper Sulphate	1	1			2 lbs./100 gal.	15	100		Excellent
					4 lbs./100 gal.	?			Clear-cut results obscured because of dry spell in May
Dithane or Parzate	1					1	1		Fairly good
Dithane Z-78	1				2-100	Trace	All		Excellent
Dithane D-14 + Zn SO_4	1	1			2 qt. + 1 lb./ 100	95	100		Fairly good to excellent depending on application

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
TOMATO (continued)									
						Trace	All		Excellent
Parzate (see under Dithane)									
Parzate		2			2 lbs./100	All			When sprays started on time and repeated once each week and after each rain, very good results obtained
						?			Clear-cut results obscured because of dry spell during three-fourths of May
Parzate Z-78	1				1 1/2 /100	5	All		Good
Parzate Liq. + Zn SO_4		1			2 qt./3/4 lb.	5	100		Fair to excellent depending on application
Zerlate (included in other sprays: See under Fixed Copper)									
Zerlate spray	1				1-2-3 (2 lbs.) + Bordeaux 3-6-100 or Fixed Copper 4 lbs. in sprays 4-5-6	83	100		Good
Zerlate followed by copper	1					5	All		Good

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Air-plane	Results and Remarks
TOMATO (continued)									
Zerlate alternating with copper			1			50	All		Control good where last two sprays were copper, poor where last spray was Zerlate
Zinc dimethyl Dithiocarbamate	1				2/100	75	99.5		Excellent
CONTROL OF CUCURBIT DOWNY MILDEW									
Bordeaux	1	1			cuc. ?-4-100 (1) melons 4-2-100	35	95		(No results given)
					4-4-50 (1)	50	100		Good. In certain fields anthracnose caused very severe damage where materials gave poor control
Fixed Copper	2				4 lbs. 50%	40	95		(No results given)

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
CUCURBITS (continued)									
					4-100				Good. When used in time, held the disease in check
Tribasic	1				3-100 (melons)	10	100		Excellent
Dithane D-14 + Zn SO_4		1			2 qts., 1/2 lb.	All	All		Generally good
Dithane Z-78	2				2-100 (2)				Good. When used in time, held the disease in check
					no formula - (melons)	5-7	100		Excellent
Zerlate	1				2-100 (melons)	5-7	100		Excellent
CONTROL OF BLUE MOLD OF TOBACCO									
Copper or Bordeaux	1				4 lbs. fixed Cu.	24	100		Fairly good
Fermate	3	2			3 lbs./100 (2)	50	100		About 25% received excellent results, 50% good and

Table 1. Spray materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
TOBACCO (continued)									
									25% none or no control. Results depended on how good a job done
						66	100		Good
					1-2 lbs./100	95	95		Excellent
					4-100	50	All		Excellent to good
					no formula	10		none	Good
Fermate - Karbam	1				2-100-4-100	70	All		Mostly good
Ferbam		1			2-3 lb./100 gal.	15			Good
Dithane		1				50		none	Good
Parzate Z-78	1					Trace			(No results given)
P. D. B.						100		none	Good

Table 2. Materials used as dusts and their effectiveness in 1949.

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
CONTROL OF LATE BLIGHT ON POTATO:									
Basicop				1	?		100		Good
Copper A.				1	"	2	100		Good
CCC-S				1	"				
CCC-S			1	1		1	100		Fairly good
					6% Met. Cu.	90	10		Good
Copper-lime dust		1			20% Cu-80% lime	5	100		Fair
Fixed Copper	2	1			7%	48	All		Good to poor
					7%	2	70	30	Fair
					6%	10		none	Good
Misc. Copper dusts		1				2	100		Good
Neutral Copper	2					90	100		Good
					7%	5	All		Good
Tribasic Copper Sulphate	1	1	1		7% Met.-Cu. in all cases	90	10		Good
						75	90	10	Good
						20	100		Good
Yellow Copper oxide		1			6% Met.-Cu.	5	100		Poor
Dithane Z-78		2			3.9% active ingredient (1)	10	100		Poor to good

Table 2. Dust materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
POTATO (continued)									
Dithane			1		Mfg. (1)	5			Good
					6%	90	10		Good
Parzate Z-78	1				10%	1	All		Good
Parzate			1		6-8%	90	10		Good-excellent
CONTROL OF LATE BLIGHT ON TOMATO									
Copper	2				7%	4	2	2	Fairly good
					6%	40	All		Good
Copper A		1			12%	?			Clear-cut results obscured because of dry spell three-fourths of May
Fixed Copper	1	1	1		20-80	25		100	Good
					5-7	5	All		Good
					6% Cu.	5	All		Poor
Copper Lime	1				20% Cu-80% Lime	5	100		Poor
Tribasic Copper Sulphate	1				7% Met. Cu.	20	100		Good

Table 2. Dust materials (continued)

Fungicide or Material	State area or Province.[a] N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by Ground Machine	Percent Applied by Airplane	Results and Remarks
TOMATO (continued)									
Yellow Copper Oxide	1				4.8%	10	100		Poor
Dithane Z-78 (commercial dust containing Dithane)		1			6%	?			Clear-cut results obscured by dry spell during three-fourths of May
Parzate Z-78	1				10%	50	All		Good
Zinc Carbamate	1				10%	5	All		Good
CONTROL OF CUCURBIT DOWNY MILDEW									
Fixed Copper	1				7%	5	5		(No results given)
Copper dusts		2			7% Met. Cu.	35	100		Good
					5%	5		none	Fair results if used properly. Very little increase in yield
Tribasic	1				5% Cu.	60	10	90	Good

Table 2. Dust materials (continued)

Fungicide or Material	State area or Province[a]: N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by: Ground Machine	Percent Applied by: Airplane	Results and Remarks
CUCURBITS (continued)									
Organic dusts (Fermate and Dithane Z-78)		1			6-1C%	15	100		Good. In certain fields anthracnose caused very severe damage where these materials gave poor control
Dithane Z-73	1	1			4-6% (watermelons)	35-40 of Acreage		over 50	Good
					4% (cantaloupes) one State	Less than 2	Total		Poor
					6%	10	10	90	Good
Zerlate	1				10%	10	20	80	Good
CONTROL OF TOBACCO BLUE MOLD									
Dithane Z-78		1			± 6 1/2% active	Experimental			Excellent
Fermate	3	4			15% (4)	very little			
						1C	All Hand dusters		Good
						75			Poor-excellent
						1C-15			Good
						few			Good
						15	100		Results almost the same as for

Table 2. Dust materials (continued)

Fungicide or Material	State area or Province[a]: N.E.	S.	M.W.	Province	Formula or Dosage	Percent using	Percent Applied by: Ground Machine	Percent Applied by: Airplane	Results and Remarks
TOBACCO (continued)									
						10		none	Fermate spray (see above) except, perhaps, a little less effective Good
Ferbam		1			15%	1			Good
Parzate		1			± 6 1/2% active	Experimental			Excellent

[a] Explanation of abbreviations:

N.E. = Northeastern States: Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, and Ohio.

S. = Southern States: Virginia, Kentucky, North Carolina, South Carolina, Tennessee, Arkansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, and Florida.

M.W. = Mid-western States: Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota, and North Dakota.

Province = Canadian Provinces: Prince Edward Island, Nova Scotia, New Brunswick, Quebec, and Ontario.

[b] ( ) Numbers in parentheses refer to number of States or Provinces using same formula; and, likewise, number of States or Provinces with same percentage of growers using where ( ) appears in "percent using" column.

THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
AGRICULTURAL RESEARCH ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 189

INDEX TO SUPPLEMENTS 180-188, 1949

Supplement 189 Issued May 15, 1950

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

P L A N T   D I S E A S E   R E P O R T E R   S U P P L E M E N T

Issued by

THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

INDEX TO PLANT DISEASE REPORTER SUPPLEMENTS 180-188, 1949

Compiled by Nellie W. Nance

Plant Disease Reporter
Supplement 189

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1949

LIST OF SUPPLEMENTS

Supplement 180. Cantaloupe mosaic investigations in the Imperial Valley. pp. 1-15. January 30, 1949. The University of California, the U. S. Department of Agriculture and the Cantaloupe Pest Control Committee of the Imperial Valley cooperating. The results of preliminary investigations by staff members assigned to the project are reported in this Supplement. See its table of contents and author index below.

Supplement 181. Nation-wide results with fungicides in 1948, fourth annual report. pp. 17-87. March 15, 1949. Compiled by the Fungicide Committee of the American Phytopathological Society: Sub-Committee on "Summation of the Performance of Newer Fungicides". See its table of contents and author index below.

Supplement 182. Fungicidal and phytotoxic properties of 506 synthetic organic compounds. pp. 89-109. March 30, 1949. By M. C. Goldsworthy and S. I. Gertler.

Supplement 183. Second annual report of the special committee on the coordination of field tests with new fungicidal sprays and dusts, with reference to the results obtained in 1948. pp. 111-177. April 15, 1949. Foreword and crop fungicide tests by various authors; see its table of contents and author index.

Supplement 184. New or unusual records and outstanding features of plant disease development in the United States in 1948. pp. 179-206. April 30, 1949. Compiled by Nellie W. Nance.

Supplement 185. Preliminary estimates of acreages of crop lands in the United States infested with some organisms causing plant diseases. pp. 207-252. August 1, 1949. Compiled by Paul R. Miller and Nellie W. Nance from reports of collaborators of the Plant Disease Survey.

Supplement 186. Losses from plant diseases: effects on crop industries and on farm life. pp. 253-282. September 15, 1949. Introduction by Jessie I. Wood and Paul R. Miller; contributions from collaborators and from county agents; see author index.

Supplement 187. Cantaloupe mosaic investigations in the Imperial Valley, 1949. pp. 283-296. December 15, 1949. This work is a continuation of that reported in Supplement 180. See its table of contents and author index below.

Supplement 188. The Plant Disease Warning Service in 1949. pp. 297-314. December 15, 1949. By Paul R. Miller and Muriel O'Brien.

Supplement 189. INDEX to Supplements 180-188. pp. 315-336 (Issued May 15, 1950).

AUTHOR INDEX

SUBJECT INDEX

ERRATA

On page 44, the first line under FRUIT ROTS, read Guignardia and Acanthorhyncus instead of Guignardia and Acanthorynchus.

CORRECTIONS FOR SUPPLEMENT 181
(From PDR 33(5):235)

I. Dr. J. W. Heuberger sends in the following corrections to be made in Supplement 181:

1. On page 56 under TENNESSEE under BUCKEYE ROT. The first part of the fifth line now reads "...were no better than the Untreated". Please take the period out after Untreated and add the following: "...except for COCS dust which reduced Buckeye Rot to 13.4% when the Untreated had 19.6%, and which reduced the percentage of total fruit rots to 19.6% when the Untreated had 29.8%. However, COCS dust was applied at a much higher rate (93 pounds of metallic copper being applied per acre) than the other dusts."

2. The following corrections should be made in the list of chemicals according to Dr. S. E. A. McCallan:

"There is no compound 163 containing a mixture of glyoxalidines, manufactured by Carbide & Carbon, possibly 169, a chromate is what is meant. Compound 531 is a chromate, not a mixture of glyoxalidines. 'Goodrite ZAC, zinc methyl dithiocarbomate Du Pont' is listed. The chemistry and manufacturer are wrong. Listed under ZAC the chemistry is right but manufacturer omitted. This a Goodrich product. Standen 307 is or was also a Goodrich product."

3. In the summary of the vegetable work, make the following changes:

(a) On page 63 under No. 2, insert "in a few tests" between phytotoxic and when so that the first line in No. 2 will read as follows: "The fact that Parzate was phytotoxic in a few tests when.........".
(b) On page 63 for CHROMATE 658 change the last sentence to read as follows: "It was injurious to tomatoes and slightly so to potatoes".

II. Dr. D. E. Ellis adds the following:

The statement in paragraph 1 at the top of page 63 "Anthracnose - North Carolina -" and under "Spergon", page 64 "- and in North Carolina -" apply to Chinese cabbage (*Brassica pekinensis Rupr*.) rather than to common cabbage (*B. oleracea var. capitata* L.)

On page 77, paragraph 3 under "Green beans, root-knot, North Carolina -": The materials used were DD, Iscobrome D (instead of Dowfume W-40) and chloropicrin, and each was applied at rates of 200, 400, and 600 pounds per acre (approximately equivalent to 20, 40 and 60 gallons per acre of DD, 27, 54 and 81 g. p. a. of Iscobrome D, and 15, 30 and 45 g. p. a. of chloropicrin).

Trademarks
(From PDR 33(10):404-405)

Ward, Blenkinsop and Co. Ltd., 6 Henrietta Place, London, W. I., send the following communication:

"Our attention has been drawn to the List of fungicides contained in Supplement 181, March 1949, of the Plant Disease Reporter. In this list you include Phenyl Mercury Fixtan as a mixture of Phenyl Mercury Hydroxide and Naphthalene Sulphonic Acid, manufactured by Imperial Chemical Industries Ltd. (PHENYL MERCURY) FIXTAN is our trade mark and manufactured by us. It is not a mixture of Phenyl Mercury Hydroxide and Naphthalene Sulphonic Acid, but the phenyl mercuric salt of 2,2′-dinaphthylmethane - 3,3 -disulfonic acid (Ind. & Eng. Chem. 41, 820, 1949).

"As described in the above reference it is a compound with affinity to fibres. It has not been submitted to any official tests by us, or with our authorisation, in fact the commercial formulation as marketed by us was not completed before March 1949, and it is therefore extremely unlikely that our compound was in fact tested for agricultural purposes by any of your co-operators.

"Because of its highly desirable properties e.g. water solubility and anchoring, the material is at present undergoing various preliminary tests for agricultural purposes, and we shall be pleased to submit any reasonable quantity for trials."