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J G. Atikins
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F. J. LeBeau and N. L. Horn

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AGRICULTURAL EXPERIMENT STATION
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FUNGICIDE TESTS ON FALL CUCUMBERS
IN LOUISIANA, 1938-1951

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Cucumbers have been grown commercially in Louisiana for about seventy years. Early accounts indicate that in the beginning the crop was relatively free of serious diseases and insect pests, but not long after the industry had become established, a blight (downy mildew, *Peronosporascubensis*) appeared which made cucumber growing unprofitable. The growers soon learned to use Bordeaux spray to control this disease. Insecticides were eventually added to the Bordeaux spray until it became standard practice to spray the cucumbers with a mixture consisting of 4-4-50 Bordeaux plus 2 to 4 pounds of lead or calcium arsenate and 1 pint of nicotine sulphate per 50 gallons. While this practice proved fairly satisfactory, it left much to be desired. In the first place, Bordeaux, although giving satisfactory control of mildew, often caused severe injury or burning of the foliage and stunting of the plants with consequent reduction in yields. Second, the insecticides used in the mixture often gave poor control of the insect pests, particularly of the pickle worm.

In cooperation with the Department of Entomology, spray and dust tests were started in 1938 in an effort to find a treatment which would equal or excel the fungicidal quality of Bordeaux mixture, cause less injury to the vines and also control the insect pests. In addition to downy mildew, anthracnose (caused by *Colletotrichum lagenarium*) also became a serious, but rather sporadic, disease of the fall cucumber crop. Because of this, since 1944 the various fungicides were evaluated for the control of both anthracnose and downy mildew. In contrast with downy mildew, anthracnose was not a serious disease each year. Anthracnose developed and became destructive only during rainy growing seasons.

Although the various fungicides have been tested for the control of cucumber foliage diseases in a number of states in addition to Louisiana, the publications covering the results obtained will not be reviewed in this bulletin. In general, the objective of the tests in such states was to control downy mildew, the most serious foliage disease. For example, in North Carolina, one of the commercial copper fungicides was considered the most economical material for the control of downy mildew (3). Preliminary reports of the Louisiana tests have been published (1, 2, 4, 5, 6).

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1Assistant plant pathologist and formerly graduate assistant, plant pathologist, associate horticulturist and superintendent Fruit and Truck Experiment Station. formerly assistant plant pathologist and assistant plant pathologist, respectively.
SYMPTOMS OF DOWNY MILDEW AND ANTHRACNOSE

Two different leaf diseases or blights seriously damage cucumbers in Louisiana. Many growers in Louisiana have failed to recognize anthracnose when present along with downy mildew. However many have recognized that they were unable to obtain good control of their "leaf blight" with copper fungicides in certain years. As an aid in distinguishing these two leaf diseases or blights of cucumbers their characteristics are listed in Table 1. Leaf symptoms of the two diseases are shown in Fig. 1 and Fig. 2.

Table 1. Distinguishing symptoms of downy mildew and anthracnose

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Downy Mildew</th>
<th>Anthracnose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of spots</td>
<td>Generally angular</td>
<td>Circular to oval</td>
</tr>
<tr>
<td>Color of spots</td>
<td>Yellowish</td>
<td>Gray to brown</td>
</tr>
<tr>
<td>Size of spots</td>
<td>About ¼ inch</td>
<td>¼ to ⅜ inch</td>
</tr>
<tr>
<td>Underside of spots</td>
<td>Frosty</td>
<td>Similar to upperside</td>
</tr>
<tr>
<td>Appearance of old spots</td>
<td>Brownish with center intact</td>
<td>Center cracked across or dropped out</td>
</tr>
<tr>
<td>Initial appearance in field</td>
<td>Light, scattered infection</td>
<td>Severe infection in a limited area</td>
</tr>
</tbody>
</table>

Figure 1.—Symptoms of downy mildew on a cucumber leaf.
Figure 2—Anthracnose infection on a cucumber leaf.

The downy mildew fungus causes yellowish to brownish angular spots on the leaves which when numerous coalesce to kill large areas or the entire leaf. A "frosty" or "downy" covering, rather dark in color, may be seen on the underside of the spots, particularly in the early morning. This downy covering contains large numbers of spores which are carried by air currents to healthy leaves, healthy plants or nearby fields. The smaller or younger spots appear water soaked when the leaves are wet with dew. The centers of the older spots are brownish in color owing to a killing of the invaded area. As the disease becomes severe the vines grow poorly, the plants are nearly defoliated and only a few marketable cucumbers are produced. Severely diseased fields appear yellowish or brownish from a distance. Downy mildew generally first appears about the middle of September on the fall crop but does not generally become severe until early October.

Leaf spots caused by the anthracnose fungus are circular to oval in shape, gray to brown in color and 1/4 to 3/4 inch in diameter. The fungus kills the leaf area within the spot rather rapidly so that the spots are generally not yellowish as with downy mildew. With strong winds or
heavy rains the larger spots break across or else the center falls out to
leave a ragged hole. When severe, anthracnose causes nearly complete
defoliation, poor vine growth, reduced yields and poor quality fruit.
Disease symptoms generally do not appear on the fruit during the picking
season. Anthracnose generally appears first on a single plant or a few
plants in a small area in a field. Spores are produced in abundance dur-
ing humid weather but must be carried to healthy leaves or plants by
physical means, generally by splashing or windblown rain. The spores are
not carried by wind during dry weather as in the case of downy mildew.
Conditions prevailing during dry weather are not favorable for spread or
establishment of the anthracnose spores. Anthracnose causes damage only
during wet seasons when conditions are favorable for the spread and
development of the disease.

SPRAY AND DUST TESTS, 1938-1951

Since 1938, cucumber fungicide tests were conducted each year, ex-
cept 1940 and 1941, by one or more of the writers. As yields were not
recorded in 1943 and 1947, the results of these tests are not included.
Most of the tests were conducted at the Fruit and Truck Experiment Sta-
tion, near Hammond, Louisiana, within the commercial area centered
in Tangipahoa Parish. Horticultural practices such as fertilization, varie-
ties, time of planting, cultivation, irrigation, and grading were those
recommended by the Louisiana Agricultural Experiment Station and
were comparable with those used by a majority of the commercial
growers. Rotary hand dusters were used for most of the dust applications
made in the early morning or late afternoon. A Bean power sprayer was
used for most of the sprays. The spray or dust applications were made
every three or four days beginning when the plants were quite small.
After 1944 cryolite and Black Leaf "10" or Black Leaf Dry Concentrate
were used as insecticides in the dust mixtures. Prior to 1944 various in-
secticides were used and these were applied only as needed. All of the
spray and dust formulae tested, number of spray or dust applications,
number of replications, size of plots, planting dates, harvest dates, yields
of No. 2 grade fruit, disease control ratings, severity of Bordeaux injury
and weather conditions varied somewhat from year to year and in-
fluenced the interpretation of results based upon yields but cannot be
given in detail or discussed. Also not listed are a number of fungicides
which were not promising after one or more tests. The tables are thus
partial summaries of the various yearly tests. Although yields of U.S. No.
1 fruit have been used primarily in evaluating the fungicides tested, ob-
servations as to plant injury and control of downy mildew and anthrac-
nose have also been used.

For convenience the tests are summarized for three time periods:
1938-1942, comparison of Bordeaux mixture and Bordeaux substitutes
with no fungicides; 1944-1946, comparison of commercial copper fungicides and Fermate, an organic fungicide, with Bordeaux mixture; and 1948-1951, evaluation of various organic fungicides.

When the fungicide tests were started in 1938 Bordeaux mixture, 4-4-50, was commonly applied with hand or knapsack sprayers at least twice weekly. Although nearly all of the growers sprayed their fall cucumber crop, a few growers used no control measures for insects and downy mildew. In the 1938, 1939 and 1942 tests summarized in Table 2 control plots receiving no fungicide were included. The results of these tests demonstrated that Bordeaux mixture gave good control of downy mildew with large yield increases. As the necessity of controlling downy mildew was clearly demonstrated in the early tests, plots receiving no fungicide were not included in the later tests. Bordeaux mixture or Tri-basic copper sulphate were then used as standards for comparison.

Although the commercial copper fungicides when used as sprays or dusts generally gave higher yields than Bordeaux mixture, observations indicated that the yield increases could not be attributed to better control of downy mildew but rather to less injury to the vines. Actually Bordeaux mixture gave better control of mildew than the commercial or fixed copper fungicides tested as Bordeaux substitutes. However Bordeaux caused serious injury to the cucumber vines. Bordeaux-injured plants exhibited one or more of the following symptoms: (1) Central portion of leaf or margin scorched, (2) older leaves brittle and stand upright, (3) margin of leaf smooth with a downward cupping (as a result of earlier marginal burning) and (4) plants dwarfed. Fig. 3 illustrates one type of Bordeaux injury. Injury from Bordeaux spray was considered to be more severe and to be more important in reducing yields on cucumbers grown without irrigation or insufficient irrigation in dry years. In

Table 2. Effect of fungicides used as sprays or dusts on yields of cucumbers—1938 to 1942.
(Yields in bushels per acre. U.S. No. 1 grade)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Concentration</th>
<th>1938*</th>
<th>Yield</th>
<th>Inc.</th>
<th>1938</th>
<th>Yield</th>
<th>Inc.</th>
<th>1939</th>
<th>Yield</th>
<th>Inc.</th>
<th>1942</th>
<th>Yield</th>
<th>Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td>41.2</td>
<td></td>
<td></td>
<td>137.7</td>
<td></td>
<td></td>
<td>82.5</td>
<td></td>
<td></td>
<td>35.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bordeaux spray</td>
<td>4-4-50</td>
<td>83.4</td>
<td>42.2</td>
<td></td>
<td>163.7</td>
<td>26.0</td>
<td></td>
<td>148.5</td>
<td>66.0</td>
<td></td>
<td>89.2</td>
<td>53.9</td>
<td></td>
</tr>
<tr>
<td>Copper spray</td>
<td>3-5-0</td>
<td>106.5</td>
<td>65.3</td>
<td></td>
<td>257.1</td>
<td>119.4</td>
<td></td>
<td>193.0</td>
<td>110.5</td>
<td></td>
<td>80.6</td>
<td>45.3</td>
<td></td>
</tr>
<tr>
<td>Copper dust</td>
<td>18%, 10%</td>
<td>70.2</td>
<td>29.0</td>
<td></td>
<td>202.8</td>
<td>65.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>112.4</td>
<td>77.1</td>
<td></td>
</tr>
</tbody>
</table>

*Baton Rouge test. No irrigation.

1Cryolite dusted on young plants in 1938 and periodically in 1939 and 1942.

2Calcium arsenate and nicotine sulphate added to spray in 1939 and 1942. Plants dusted with cryolite while small in 1938.


4Dust contained 18% Spray Cop or approximately 6% metallic copper in 1938 and 1939. The 1942 dust, 10% Tri-Basic Copper Sulphate (5.3% metallic copper). Alternate applications of dust with and without arsenicals and rotenone in 1938 and 1939. 1942 dust contained 30% cryolite.
general, Bordeaux injury, particularly dwarfing, was considered to be more severe in seasons of low rainfall even with irrigation.

The 1938 tests, as well as those for other years, demonstrated that Bordeaux mixture gave good control of downy mildew at low cost but caused rather severe injury. Some of the early tests with the commercial copper sprays or dusts were not too satisfactory. However as more information was obtained as to the effective concentration of fungicides, selection of insecticides and time and frequency of applications, excellent results were obtained, as shown in Table 3.

Table 3. Comparison of various fungicides with Bordeaux mixture on cucumber yields, 1944 to 1946. Yields in bushels per acre.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1944</th>
<th>1945</th>
<th>1946</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bordeaux spray^1</td>
<td>4.5-50</td>
<td>108.6</td>
<td></td>
</tr>
<tr>
<td>Copper dust^2</td>
<td>12%</td>
<td>114.5</td>
<td>5.9</td>
</tr>
<tr>
<td>Copper dust^3</td>
<td>8%</td>
<td>133.2</td>
<td>24.6</td>
</tr>
<tr>
<td>Cuprocide dust^4</td>
<td>5%</td>
<td>105.5</td>
<td>-3.1</td>
</tr>
<tr>
<td>Fermate dust^5</td>
<td>10%</td>
<td>106.5</td>
<td>-8.9</td>
</tr>
<tr>
<td>Copper spray^6</td>
<td>2.50</td>
<td>115.3</td>
<td>6.7</td>
</tr>
</tbody>
</table>

^1 Lead or calcium arsenate, 4 lbs., and nicotine sulphate, 1 pt., per 50 gallons.
^2 Tri-Basic Copper Sulphate, 1944 and 1945. Copper A Compound, 1946. Dust contained cryolite (30%-1944, 20%-1945 and 1946) and 10% Black Leaf “10” (1% nicotine).
^3 Contained cryolite (30%-1944, 20%-1945 and 1946) and 10% Black Leaf “10” (1% nicotine).
^4 Cryolite, 4 lbs., and nicotine sulphate, 1 pt., per 50 gallons.

Beginning with the 1944 tests, a second foliage disease or blight, known as anthracnose, became an important disease and all treatments were evaluated for the control of both downy mildew and anthracnose. Fermate (ferric dimethyl dithiocarbamate, 70%), the first organic fungicide tested (see 1945 results in Table 3), gave yields considerably higher than the copper fungicides when anthracnose was severe. Examination of the test plots showed that Fermate gave good control of both downy
mildew and anthracnose. The copper fungicides gave good control of
downy mildew but poor control of anthracnose. Bordeaux mixture gave
somewhat better control of anthracnose than did the commercial copper
fungicides. Fig 4B illustrates the control of anthracnose afforded by Fer-
mate in comparison with a copper fungicide.

Yellow Cuprocide caused injury to the cucumber plants in 1944 at the concentration used. Some of the other commercial copper fungicides, such as Copper Compound A and Tri-Base Copper Sulphate, caused slight injury, particularly a slight marginal chlorosis of the leaves, in a number of tests. However the injury was not severe as with Bordeaux mixture.

After 1946 emphasis was placed on testing various dust formulations, particularly those containing organic fungicides, rather than on spray mixtures. By this time a large number of growers had shifted from the use of Bordeaux mixture and knapsack sprayers to commercial dusts and rotary hand dusters. The growers have justifiably preferred dusting to spraying since this practice reduces labor by at least 50 per cent, gives better control of insects and eliminates the necessity of mixing the spray material.

In addition to Fermate, Dithane Z-78 and Parzate (both containing zinc ethylene bisdithiocarbamate, 65%) were found in tests since 1946 to give good control of both anthracnose and downy mildew and high yields, as shown in Table 4.

Table 4. Yields given by several organic fungicides in comparison with a standard copper fungicide, 1948 to 1951. Yields in bushels per acre.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Concentration*</th>
<th>1948 Yield</th>
<th>1949 Yield</th>
<th>1950 Yield</th>
<th>1951 Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tri-Base</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper Sulphate</td>
<td>13.5%</td>
<td>231.1</td>
<td>201.3</td>
<td>428.2</td>
<td>94.2</td>
</tr>
<tr>
<td>Fermate</td>
<td>8.0%</td>
<td>203.3†</td>
<td>206.6</td>
<td>466.5</td>
<td>147.2</td>
</tr>
<tr>
<td>Dithane Z-78</td>
<td>8.0%</td>
<td>240.5</td>
<td>238.8</td>
<td>475.4</td>
<td>174.5</td>
</tr>
<tr>
<td>Parzate (dry)</td>
<td>8.0%</td>
<td>195.4</td>
<td>216.4</td>
<td>454.5</td>
<td>154.6</td>
</tr>
<tr>
<td>Orthocide 406</td>
<td>8.0%</td>
<td></td>
<td>210.6</td>
<td>450.6</td>
<td>147.8</td>
</tr>
<tr>
<td>Crag Potato</td>
<td></td>
<td></td>
<td></td>
<td>110.7</td>
<td>16.5</td>
</tr>
<tr>
<td>Fungicide</td>
<td>8.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Percentages refer to amount of the commercial product included in the dust mixtures on a weight basis rather than on the active ingredient basis. All dust mixtures contained 20% cryolite and 1% nicotine.
†Average three Fermate dusts, 4, 6 and 8%.

Parzate caused some injury to the cucumber plants in the 1948 tests but little or no injury in the later tests. However, Dithane Z-78 generally gave slightly higher yields and more vigorous plants than Parzate. In the 1948 and 1950 tests anthracnose was either not present or present in small amounts and did not affect yields. In the 1949 test anthracnose developed late in the season and did not drastically affect yields. However,
in 1951 anthracnose injury was severe on plots dusted with relatively ineffective fungicides (see Fig. 4A) and yields were reduced. Orthocide 406 (N-trichloromethylthio tetrahydrophthalimide, 50%) gave promising results in 1949, 1950 and 1951 on the basis of yields and control of anthracnose and downy mildew. Crag Potato Fungicide (Copper zinc chromate complex) gave rather poor control of anthracnose in 1949 and 1951.

**Figure 4.** Comparison of effective and relatively ineffective fungicides on control of foliage diseases, chiefly anthracnose, in 1945 and 1951. A. Left, Dithane Z-78 6% dust; right, Crag Potato Fungicide 8% dust. Photograph Oct. 12, 1951. B. Left, Tri-Basic Copper Sulphate 7% (metallic copper basis); right, Fermate 10% dust. Photograph Nov. 13, 1945.
In certain tests anthracnose damage, consisting of defoliation, poor vine growth and poor yields, increased as the season progressed in plots receiving fungicides giving poor control of this disease. The cucumber plants in such plots were severely damaged or essentially dead before the end of the harvest season, as shown in Fig. 4, while those receiving effective fungicides continued growth until killed by frost. Effective treatments, such as Dithane Z-78 and Fermate, gave two to four extra pickings in comparison with ineffective fungicides. Similar results were obtained by grower cooperators in years when anthracnose damage was severe. Total yields for the season and total yields for three arbitrary harvest periods are shown in Graph I to illustrate the decrease in yields given by relatively ineffective fungicides in comparison with superior fungicides during the latter part of the harvest season. In 1951, Experimental

**Graph 1.** Comparative yields given by eight treatments for three arbitrary harvest periods to illustrate effect of differential control of anthracnose upon yields during the latter part of the season.
Fungicides NP-492 (Pennsylvania Salt Manufacturing Company), Tri-Basic Copper Sulphate and Crag Potato Fungicide gave low yields in the latter part of the harvest season as shown in the graph. The effective fungicides, Dithane Z-78, Fermate, Parzate and Orthocide 406, continued to produce satisfactory yields until picking was discontinued.

Along with the extensive tests at the Fruit and Truck Experiment Station a number of demonstrational tests were conducted in cooperation with commercial growers. Some of these tests are summarized in Table 5. In general, the newer fungicides considered promising on the basis of tests at the Experiment Station were compared with the material being used by the grower. Although certain of the tests were not replicated, the yields (recorded by the growers) corresponded with the general appearance of the respective tests plots. In comparison with copper fungicides, Dithane Z-78 and Fermate doubled yields in 1947 and 1949 when anthracnose was severe. In dry seasons when anthracnose was light or absent, marked differences were not apparent between plots receiving copper fungicides and Fermate or Dithane Z-78.

**DISCUSSION**

Yields of No. 1 grade or marketable slicing cucumbers have been used primarily in this bulletin in discussing the results of spray and dust tests. Since cucumbers with worm injury cannot be placed in No. 1 grade and many such fruits are encountered with poor insect control, results based upon yields of No. 1 grade cucumbers represent a combination of disease and insect control. Some of the early dust formulations were actually more promising on the basis of downy mildew control and freedom from injury than the yields in Table 2 indicate. Also, the arsenates used with Bordeaux mixture were inferior to cryolite. Thus three important factors influencing yields of No. 1 grade fruit are insect control, disease control and amount of vine injury. The yields of the later tests presented in Table 4 represent chiefly differences in disease control, since cryolite and nicotine were used in all dust formulations.
Spray mixtures containing commercial copper or organic fungicides, cryolite and nicotine sulphate gave satisfactory results, particularly from the standpoint of yields. However this combination cannot be recommended since, according to Experiment Station entomologists, the nicotine sulphate included for the control of aphids would not be effective unless an alkaline material, such as soap or lime, was added to the spray mixture. But cryolite cannot be used in combination with lime. Consequently none of the fungicides can be recommended for use as sprays, for lack of materials considered satisfactory for the control of aphids and insects on cucumbers in Louisiana.

Although the relative increase (or decrease) in yields for the various fungicides varied from year to year, the yield data from the various tests constitute a good evaluation. From a statistical standpoint some of the differences in certain of the tests were not significant. In other tests differences in yields between fungicides were statistically significant but differences in appearance of the plots were clearly evident, as shown in Figure 4. In the cooperative tests with commercial growers, as well as those at the Experiment Station, the fungicides which doubled the yields and gave differences in disease control as illustrated in Figure 4 recommended themselves to the growers.

From a practical standpoint the selection of a fungicide-insecticide treatment involves cost of ingredients, cost of application, amount of labor available, probable market price of cucumbers and average “expected” yields per acre. Experimental results for a period of years and numerous observations of commercial fields indicate that a grower should produce an average yield of at least 200 bushels per acre with recommended pest control and horticultural practices, unless very adverse weather conditions prevail. The ingredients for Bordeaux mixture cost less, on an acre basis, than the required amount of dust. However dusting results in a labor saving of at least 50 per cent. Primarily for this reason dusting became popular in Louisiana. Dusts containing one of the organic fungicides cost more than the copper dusts but, when properly used, provide protection or “insurance” against the destructive losses of anthracnose.

**SUMMARY**

Anthracnose and downy mildew are serious leaf diseases on the fall cucumber crop in Louisiana. Practically all growers recognize that diseases and insects must be controlled in order to produce a profitable crop. Downy mildew generally causes serious losses each year unless controlled. Anthracnose, a sporadic but very destructive disease, results in serious losses only during wet seasons or following a period of rainy and stormy weather, particularly tropical storms. In the cucumber fungicide tests started in 1938 anthracnose did not become a factor until about 1941.
In the early tests Bordeaux mixture was found to give good control of downy mildew with marked yield increases in comparison with plots which received no fungicide. However Bordeaux injury was frequently severe. Dusts containing 7 per cent metallic copper and insecticides were found to give good control of mildew and insects, little injury to the cucumber plants and higher yields than Bordeaux mixture. Dusts containing one of the copper fungicides and insecticides came into wide use in Louisiana.

In later tests, 1944 to 1951, the commercial copper fungicides were found to give poor control of anthracnose in comparison with certain of the organic fungicides when conditions were favorable for the anthracnose disease. Fermate, Dithane Z-78, Parzate and Orthocide 406 gave good control of both anthracnose and downy mildew, little or no plant injury and high yields. In comparison with copper fungicides, Fermate and Dithane Z-78 doubled the yields under conditions favorable for severe anthracnose damage. Since the copper fungicides gave poor control of this sporadic disease, certain of the organic fungicides are recommended as protection or "insurance" against the destructive losses of anthracnose.

LITERATURE CITED

RECOMMENDATIONS

1. For the control of downy mildew and anthracnose use a dust containing Dithane Z-78, Fermate, Parzate or Orthocide 406 prepared according to the formula given below.

   **L.S.U. CUCUMBER DUST FORMULA**

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungicide*</td>
<td>8 lbs.</td>
</tr>
<tr>
<td>Cryolite</td>
<td>20 lbs.</td>
</tr>
<tr>
<td>Black Leaf “10”</td>
<td>10 lbs.</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Black Leaf Dry Concentrate</td>
<td>7 lbs.</td>
</tr>
</tbody>
</table>
   | Diluent†                   | 62 lbs.  if Black Leaf “10” is used
   |                            | 65 lbs.  if Black Leaf Dry Concentrate is used

   *Dithane Z-78, Fermate, Parzate or Orthocide 406.
   †Talc, pyrophyllite or clay.

2. Dust should be applied twice weekly. New growth should be kept covered with a residue of the dust mixture. As anthracnose may cause damage on young plants, start dusting when the plants are small.

3. Thorough dust applications are necessary. The dust should be applied only when there is little or no wind—either early in the morning or in late afternoon.

4. Rotary hand dusters are satisfactory for applying the dust mixtures but should be maintained in good mechanical condition.

5. An application of straight or 50 per cent cryolite may be used for the control of beetles on very young cucumber plants.

6. The percentages of insecticides contained in the dust formula are considered sufficient for the control of the cucumber insects if the applications are made twice weekly. However if the aphid infection becomes heavy a stronger nicotine dust must be used.

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*Joint recommendation of the Departments of Plant Pathology and Research Entomology, Louisiana Agricultural Experiment Station.*