1976

The Control of Anthracnose and Pod and Stem Blight of Soybean by Application of Foliar Fungicides.

Thomas Morton Fort III
Louisiana State University and Agricultural & Mechanical College

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_disstheses

Recommended Citation
https://digitalcommons.lsu.edu/gradschool_disstheses/3016

This Dissertation is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.
INFORMATION TO USERS

This material was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.

2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in "sectioning" the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.

4. The majority of users indicate that the textual content is of greatest value, however, a somewhat higher quality reproduction could be made from "photographs" if essential to the understanding of the dissertation. Silver prints of "photographs" may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.

5. PLEASE NOTE: Some pages may have indistinct print. Filmed as received.

University Microfilms International
300 North Zeib Road
Ann Arbor, Michigan 48106 USA
St. John’s Road, Tyler’s Green
High Wycombe, Bucks, England HP10 8HR
FORT, Thomas Morton, III, 1946-
THE CONTROL OF ANTHRACNOSE AND POD AND
STEM BLIGHT OF SOYBEAN BY APPLICATION
OF FOLIAR FUNGICIDES.

The Louisiana State University and
Agricultural and Mechanical College,
Ph.D., 1976
Agriculture, plant pathology

Xerox University Microfilms, Ann Arbor, Michigan 48106
THE CONTROL OF ANTHRACNOSE AND POD AND STEM BLIGHT
OF SOYBEAN BY APPLICATION OF FOLIAR FUNGICIDES

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Plant Pathology

by

Thomas Morton Fort, III
B.S., North Georgia College, 1968
M.S., University of Georgia, 1974
December, 1976
ACKNOWLEDGEMENT

The author expresses warm gratitude to his wife, Bobbie, and his son, Jeff, for their sacrifice, patience, and understanding throughout his graduate program.

To his major professor, Dr. Norman Horn, and his Cooperative Extension Service group leader, Dr. Randall Carver, the author expresses sincere appreciation for their interest, assistance, and advice throughout the course of this work. To the scientists on his committee, Drs. Sess Hensley, Louis Anzalone, and J. P. Snow, the author expresses appreciation for advice and constructive critique of this manuscript.

The author thanks the Louisiana Cooperative Extension Service for financial assistance and support during the course of this work.

The author thanks Leigh Simmons, Norman Walker, Don Bonoil, and John Horn for technical and field assistance in this work.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>viii</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>3</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>5</td>
</tr>
<tr>
<td>RESULTS</td>
<td>20</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>62</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>67</td>
</tr>
<tr>
<td>VITA</td>
<td>69</td>
</tr>
</tbody>
</table>


**LIST OF TABLES**

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fungicides used in screening tests on soybeans in Louisiana, 1975-76</td>
<td>13</td>
</tr>
<tr>
<td>2. The location, type of experiment, and variety used for soybean outfield fungicide experiments</td>
<td>15</td>
</tr>
<tr>
<td>3. The yields in hl/ha of Dare, Curtis and Bragg soybean varieties inoculated with fungi or treated with 0.28 kg/ha of benomyl at Burden Research Farm, Baton Rouge, Louisiana</td>
<td>21</td>
</tr>
<tr>
<td>4. Yields in hl/ha of Curtis soybeans sprayed with 0.28 kg/ha of benomyl, 0.54 kg/ha of fentin hydroxide, or 184.2 ml/ha of thiabendazole at the Burden Research Farm, Baton Rouge, Louisiana, 1975, at four timing sequences</td>
<td>25</td>
</tr>
<tr>
<td>5. Yields in hl/ha of Bragg soybeans sprayed with 0.28 kg/ha of benomyl, 0.54 kg/ha of fentin hydroxide, or 184.2 ml/ha of thiabendazole at the Burden Research Farm, Baton Rouge, Louisiana, 1975, at four timing sequences</td>
<td>27</td>
</tr>
<tr>
<td>6. Yields (hl/ha) of Curtis soybeans sprayed with benomyl, thiabendazole, chlorothalonil, or captafol at different timing sequences. Burden Research Farm, Baton Rouge, Louisiana, 1976</td>
<td>30</td>
</tr>
<tr>
<td>7. Yields (hl/ha) of Dare soybeans sprayed with benomyl, thiabendazole, chlorothalonil, or captafol at different timing sequences. Burden Research Farm, Baton Rouge, Louisiana, 1976</td>
<td>32</td>
</tr>
<tr>
<td>8. Yields$^a$ in hl/ha of Curtis, Dare and Coker 136 soybean varieties treated$^b$ with fungicides in fungicide screening experiments in Louisiana, 1975</td>
<td>35</td>
</tr>
<tr>
<td>9. Yields$^a$ in hl/ha of Curtis, Dare and Davis soybean varieties treated$^b$ with fungicides in fungicide screening experiments in Louisiana, 1976</td>
<td>37</td>
</tr>
<tr>
<td>10. Mean$^a$ yields in hl/ha of soybean varieties sprayed twice$^b$ by airplane with 0.28 kg/ha benomyl in 28.1 or 46.8 l/ha of water. All locations are in Louisiana</td>
<td>39</td>
</tr>
</tbody>
</table>
**LIST OF TABLES**  
(Continued)

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Mean&lt;sup&gt;a&lt;/sup&gt; yields in hl/ha of soybeans treated with two applications&lt;sup&gt;b&lt;/sup&gt; of 0.28 kg/ha of benomyl applied with a hi-boy in Louisiana, 1975</td>
<td>41</td>
</tr>
<tr>
<td>12. Mean&lt;sup&gt;a&lt;/sup&gt; yields of soybeans treated&lt;sup&gt;b&lt;/sup&gt; with different rates of thiabendazole, Louisiana, 1975</td>
<td>42</td>
</tr>
<tr>
<td>13. Mean yields of four replications per treatment of Bragg soybeans at Batchelor, Louisiana, 1976, treated&lt;sup&gt;a&lt;/sup&gt; with 1.26 l/ha of chlorothalonil in different amounts of water/ha and 0.28 kg/ha of benomyl and 184.2 ml/ha of thiabendazole in 46.8 l/ha of water</td>
<td>43</td>
</tr>
<tr>
<td>14. Yield&lt;sup&gt;a&lt;/sup&gt; in hl/ha of soybeans at four locations in Louisiana treated&lt;sup&gt;b&lt;/sup&gt; with fungicides&lt;sup&gt;c&lt;/sup&gt; applied by hand sprayer which provided 2.81 kg/cm&lt;sup&gt;2&lt;/sup&gt; constant pressure with CO&lt;sub&gt;2&lt;/sub&gt; and delivered 160.0 l/ha of formulation</td>
<td>45</td>
</tr>
<tr>
<td>15. Mean yields of soybean varieties treated with 0.56 kg/ha of benomyl at the Dean Lee Agriculture Center, 1976</td>
<td>48</td>
</tr>
<tr>
<td>16. Means of four replications of total seed weight (g), number of pods, and number of seed of Dare and Davis soybeans grown in the greenhouse and sprayed with fungicide, Baton Rouge, Louisiana, 1976</td>
<td>49</td>
</tr>
<tr>
<td>17. Average culture diameter (cm) and percent inhibition of growth of Colletotrichum dematium var. truncata, isolate 7616, and Diaporthe phaseolorum var. sojae, isolate 7617, growing on potato dextrose agar containing fungicides at different concentrations (ppm-volume)</td>
<td>51</td>
</tr>
<tr>
<td>18. Percent germination of soybean seed from plants treated with foliar fungicide and from untreated plants in Louisiana, 1976</td>
<td>54</td>
</tr>
<tr>
<td>19. Percent of seed found to be infected with Diaporthe spp. from soybean plants sprayed with foliar fungicides and from untreated plants</td>
<td>55</td>
</tr>
<tr>
<td>20. Disease ratings from Curtis plants inoculated with fungi, Burden Research Farm, Baton Rouge, Louisiana, 1975</td>
<td>56</td>
</tr>
</tbody>
</table>
LIST OF TABLES
(Continued)

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. Disease ratings from Dare plants inoculated with fungi, Burden Research Farm, Baton Rouge, Louisiana, 1975</td>
<td>58</td>
</tr>
<tr>
<td>22. Petiole disease ratings from Curtis and Bragg varieties in the R-7 stage, Burden Research Farm, Baton Rouge, Louisiana, 1976</td>
<td>61</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Soybean stem and pods infected with <em>Diaporthe phaseolorum</em> var. <em>sojae</em>. Pycnidia are arranged in linear rows, a characteristic of pod and stem blight.</td>
</tr>
<tr>
<td></td>
<td>Page 8</td>
</tr>
<tr>
<td>2.</td>
<td>Soybean stem and pods infected with <em>Colletotrichum dematium</em> var. <em>truncata</em>. Characteristic flat pods are present at upper nodes.</td>
</tr>
<tr>
<td></td>
<td>Page 9</td>
</tr>
<tr>
<td>3.</td>
<td>Petioles of soybean plants used for disease ratings. Benomyl-treated petioles on left and untreated petioles on right. Stem ends are immersed in water. Petioles from the untreated plants are highly discolored.</td>
</tr>
<tr>
<td></td>
<td>Page 10</td>
</tr>
<tr>
<td>4.</td>
<td>Curtis soybean plants. Benomyl-treated plants showing delayed maturity are on the left. Plants on the right are untreated.</td>
</tr>
<tr>
<td></td>
<td>Page 24</td>
</tr>
<tr>
<td>5.</td>
<td>Seed and pods of Dare soybeans grown in an apparently disease-free environment. A. Seeds showing no discoloration. B. Pods showing no signs of fungal infection.</td>
</tr>
<tr>
<td></td>
<td>Page 52</td>
</tr>
</tbody>
</table>
ABSTRACT

Attempts were made to evaluate the use of foliar fungicides to control soybean pod and stem diseases. The lower incidence of *Dia­porthe* spp. on seeds from fungicide-treated plants, lower disease ratings of fungicide-treated plants, yield increases with a wide variety of fungicides, yield increases of many varieties sprayed with benomyl, lack of increased yields of fungicide-treated varieties grown in an essentially disease-free environment, and growth inhibition of *Colletotrichum dematium* var. *truncata* and *Diaporthe phaseolorum* var. *sojae* with low concentrations of fungicides in vitro were considered substantial evidence that disease control was the major factor involved in yield increases.

The yields from benomyl-treated Curtis and Bragg soybean plants in 1975 and Bragg in 1976 were significantly greater than those of plants inoculated with a combination of *C. dematium* var. *truncata*, *Cercospora sojina*, *Corynespora cassicola*, and *D. phaseolorum* var. *sojae*. Inoculation with *C. dematium* var. *truncata* alone did not cause significant yield losses.

Late flowering to early pod set and again in 2 weeks was the most effective timing sequence in nearly all experiments for the application of the foliar fungicides benomyl, chlorothalonil and thiabendazole to increase yields. Varieties sprayed by airplane with
two applications of 0.28 kg/ha/application of benomyl in 46.8 l/ha of water at this timing sequence produced significantly higher yields than the controls and was superior to the same fungicide applied in 28.1 l/ha of water.

In field screening tests which were designed to search for disease control fungicides, Benlate, Bravo 6F, Duel, Mertect 340F, and RH3928; combinations of Benlate and Du-Ter, Bravo 6F, Captan 80W, Difolatan 4F, and Mertect 340F; Duel plus Benlate or Bravo 6F; and RH3928 plus M-45 were the most effective treatments tested. When some of these fungicides were applied to Dare, Curtis, Davis, and Coker 136 varieties, significant yield increases over the controls were obtained at various geographical locations.

In tests to measure the responses in yields of various varieties to applications of benomyl at the rate of 0.28 kg/ha in applications at late flowering to early pod set and 2 weeks later, Mack, Dare, Forrest, Davis, Curtis, Pickett 71, and Bragg were significantly higher than the controls.

Dare and Davis varieties grown in the greenhouse under apparently disease-free conditions did not respond to applications of benomyl, chlorothalonil, fentin hydroxide and thiabendazole. The yields and number of pods or seeds were not significantly higher than the controls.

Benomyl, captafol, chlorothalonil, fentin hydroxide and thiabendazole incorporated into potato dextrose agar had a growth-inhibiting effect on C. dematium var. truncata and D. phaseolorum var. sojae.
at concentrations of 1-500 ppm. Captafol at 50 ppm and benomyl at 500 ppm stopped the growth of *C. dematium* var. *truncata*. Benomyl, captafol, fentin hydroxide and thiabendazole stopped the growth of *D. phaseolorum* var. *sojae* at 500 ppm. All the *in vitro* studies indicated fungistatic control only.

Seeds from control plants germinated in the laboratory indicated a significantly greater incidence of seed-borne infection with *Diasporthe* spp. than those from benomyl, chlorothalonil, or fentin hydroxide-treated plants in three of four locations. The varieties involved were Lee 74, Davis, Mack, Forrest and Bragg.

The results of these tests have shown that pod and stem diseases of soybeans were controlled by a foliar fungicide spray schedule which resulted in significantly higher yields than the controls.
INTRODUCTION

Yields of soybean (Glycine max (L.) Merrill) varieties have been shown to be increased when treated with certain foliar fungicides (5, 6, 7). Increases in weight and number of seed per plant have been proposed to explain the yield increases (6, 7). Conversely, Lee (7) and Horn et al. (6) have shown that yields of Dare, Curtis, and Bragg varieties were reduced significantly when inoculated with a combination of Cercospora sojina Hara, Corynespora cassicola (Burk. & Curt.) Wei. and Diaporthe phaseolorum (Che. & Ell.) Cacc. var. sojae Lehman Wehm. Their results indicated that seeds from infected plants weighed less than those from fungicide-treated or control plants.

A delay in maturity of about 1 week has been associated with soybeans treated with foliar fungicides (6, 7). Wensley (16) has reported an increased growth rate in benomyl-treated muskmelon plants. This in conjunction with known fungicide-induced yield increases (5, 6, 7) has led to speculation that a growth regulation effect on fungicide-treated soybeans is responsible for yield increases. The question then arises as to the relationship between fungicide-induced yield increases and fungal disease control.

Although four of the fungi commonly associated with soybeans in Louisiana have been studied in conjunction with effects on yield (7), a very commonly occurring one, Colletotrichum dematium var. truncata
(Schw.) v. Arx, causal agent of soybean anthracnose, has not. This disease has been reported to be of little importance in the midwestern United States, and most commercial varieties are reported to be resistant to it (1). The frequency with which the symptoms and signs of the disease can be observed in Louisiana raise the question of the validity of the above reports as they apply to soybeans grown in the midsouthern United States, especially Louisiana.

Since the commercial use of foliar fungicides on soybeans is relatively new, many practical questions such as timings, rates, methods and numbers of applications, formulations, efficacy of untested fungicides, effect of geographical location, response of different cultivars, and others need answering.

One purpose of the work reported here was to determine whether or not relationships exist between the control of pod and stem diseases of soybeans, and the use of foliar fungicides on soybeans. A second purpose was to determine the effect of C. dematium var. truncata on soybeans artificially inoculated with it alone and in combination with C. sojina, C. cassicola, and D. phaseolorum var. sojae. Other purposes included refining existing information concerning application of fungicides labelled or judged by the manufacturer to be approaching labelling by the Environmental Protection Agency for use on soybeans.
LITERATURE REVIEW

Pod and stem blight of soybeans, caused by *Diaporthe phaseolorum* var. *sojae*, is a widely spread disease geographically (11). It has been associated with poor seed quality (3, 4, 10, 15, 18) and seedling infections (2, 8, 10, 17). It over-winters easily on a number of hosts (11) and conidial survival and longevity are high (11). Luttrell (10) has described the organism as a vigorous saprophyte and it is thought to enter plants mainly through wounds. The mycelium can also survive in plants which survive from infected seed. After entering the plant, *D. phaseolorum* var. *sojae* can colonize the entire plant (8, 10), presumably moving mainly within the cortex and tracheae. Seed may become infected from within the plant (3). High environmental moisture levels and delay in harvest appear to increase the amount of infection, especially in seed (18).

The causal organism of soybean anthracnose was originally described as *Colletotrichum glycines* and has also been referred to as *C. truncatum* and *C. caulivorum*. In 1957 von Arx (14) combined all the above species into one, *C. dematium* var. *truncata*. This is the same organism that causes stem anthracnose of lima bean (*Phaseolus limensis*) (11). Soybean anthracnose is more prevalent in the southern and lower midwestern United States than in the colder northern states (1, 11). It has also been found in Korea and Japan (9).
Overwintering of *C. dematium* var. *truncata* is thought to occur on plant debris in the soil (11, 13). It can also survive in seed (9). Lehman and Wolf (9) and Tiffany (12) reported the systemic nature of the disease in 1926 and 1951, respectively, but little work has continued in recent years. The conidia of *C. dematium* var *truncata* germinate fairly easily (11) and are known to form appressoria and penetration pegs (9, 12). Tiffany (12) reported three types of infection: 1. pre-emergence killing. 2. seedling blight, and 3. symptomless establishment of internal mycelium. The mycelium in symptomless plants was found to grow slowly during the vegetative growth stage of the plant until 7-10 days prior to flowering.

Lehman and Wolf (9) found mycelium in young symptomless pods during the pod set stage. Some infected pods later developed acervuli on the surface, while others did not. The effect of anthracnose on soybean yields has not been shown.

Attempts to control pod and stem blight and anthracnose on soybeans have been limited to cultural practices (1, 11), fungicide seed treatment (11), and resistant cultivars (1, 11). The use of foliar fungicides on soybeans has become widespread in Louisiana, however, whether pod and stem diseases are controlled by these fungicides has not been shown. Little work has been done to determine the stage of plant growth at which foliar fungicides most efficiently induce yield increases.
MATERIALS AND METHODS

Fungus inoculation, fungicide timing, and fungicide screening tests. Soybean varieties Bragg, Curtis, and Dare were planted May 21, 1975 and May 19, 1976 at the Louisiana State University Agricultural Experiment Station, Burden Research Center, Baton Rouge, Louisiana. In 1975, plots were three rows wide with 1.2 m spacings and 6.1 m long with 1.5 m alleys. In 1976, the plots were increased to four rows wide. The soil type was Olivier silt loam. Cultivation was the method of weed control in 1975, but in 1976 control was accomplished with a broadcast, preplant application of Treflan (Elanco) followed by cultivation. Plots were completely randomized with four replications in all experiments. During both years, Dipel, active ingredient Bacillus thuringiensis, was applied once at the rate of 0.84 kg/ha in 160.0 l of water/ha by hi-boy to control phytophagous insects.

Fungicides were applied with a hand-carried sprayer which provided a constant pressure of 2.81 kg/cm² from compressed CO₂, and which delivered 160.0 l of liquid/ha. The spray boom had four nozzles with No. 8 T-Jet tips which were arranged and adjusted to provide coverage of two rows when the boom was held about 30.0 cm above the plants.

A set of experiments was designed to test the effect of anthracnose (C. dematium var. truncata) inoculation alone and in combination
with other fungi on soybean yields. Bragg, Curtis, and Dare varieties were tested in 1975 and Curtis and Bragg in 1976. Treatments in 1975 were: A. untreated controls; B. 0.56 kg/ha of benomyl (methyl-1 (butylcarbamoyl)-2-benzimidazolecarbamate) (Dupont); C. *C. dematium* var. *truncata* inoculum; D. combination of *C. dematium* var. *truncata*, *D. phaseolorum* var. *sojae*, Corynespora cassicola and Cercospora sojina inoculum; E. combination of *D. phaseolorum* var. *sojae*, *C. cassicola*, and *C. sojina* inoculum. A treatment was added in 1976 which included 0.56 kg/ha of benomyl and inoculum as in treatment E. Benomyl was applied twice by the method described above. The first benomyl application was at the late flowering, early pod set stage (LFEPS) and the second was 2 weeks later.

Fungal isolates used for inoculum were isolated from soybean plants or debris from the Burden Research Center in the fall of 1974. Cultures were maintained in 9.0 cm petri dishes at room temperature under a continuous black light (Westinghouse 20 watt F20T12) for 14-17 days prior to inoculation. *Diaporthe phaseolorum* var. *sojae* and *C. cassicola* were grown on PDA whereas lima bean agar and V-8 juice agar were used to culture *C. dematium* var. *truncata* and *C. sojina*, respectively.

Field inoculum was prepared from agar cultures which were homogenized in a 0.01% Tween 20 solution and strained through two layers of cheese cloth. The contents of 15 petri dishes for each genus were divided equally among all treatments. Inoculum was applied with 18.7 l hand sprayers with enough volume of tap water to cover an entire
treatment thoroughly. Inoculum was applied six times to each variety beginning at R-2 stage (LFEPS) with 2 weeks between applications. To prevent desiccation of the inoculum, applications were usually made 1.0-1.5 hours before dark.

Pods and stems were rated for severity and prevalence of pod and stem blight (Fig. 1) and anthracnose (Fig. 2) in 1975. Ratings were made on Curtis and Dare as follows: prevalence - 0. none, 1. 1%-25%, 2. 26%-50%, 3. 51%-75%, 4. >75%; severity - 0. none, 1. very light, 2. light-moderate, 3. severe, 4. very severe or entire. Prevalence was a qualitative rating and severity was quantitative.

In 1976 disease ratings were made from observations of 10 petioles in four replications obtained from plants in the R-7 (50% of leaves yellow) stage. Petioles were incubated at room temperature in 355.0 ml paper cups containing 100.0 ml tap water changed daily for about 7 days (Fig. 3). Disease ratings were assigned in the following manner. Any petiole over 50% diseased, i.e. disease signs on more than 50% of petiole area, was given 1.0. Petioles considered less than 50% diseased were assigned a rating of zero. Totals for replications of a treatment were averaged and the value assigned to that treatment.

Fungicide timing tests were conducted on Curtis and Dare varieties in 1975 and 1976. The fungicides were applied as described above. Treatments in 1975 included 0.28 kg/ha of benomyl, 307.0 ml/ha of thiabendazole (2-(4-thiazolyl)benzimidazole) (Merk Chemical), and 0.54 kg/ha of fentin hydroxide (triphenyltin hydroxide) (Thompson-Hayward, Inc.) applied at four different timings. The timings were
Fig. 1. Soybean stem and pods infected with *Diaporthe phaseolorum* var. *sojae*. Pycnidia are arranged in linear rows, a characteristic of pod and stem blight.
Fig. 2. Soybean stem and pods infected with Colletotrichum dematium var. truncata. Characteristic flat pods are present at upper nodes.
Fig. 3. Petioles of soybean plants used for disease ratings. Benomyl-treated petioles on left and untreated petioles on right. Stem ends are immersed in water. Petioles from the untreated plants are highly discolored.
1. late flowering to early pod set (LFEPS), 2. LFEPS and again 2 weeks later, 3. full green pod (FGP), and 4. FGP and again 2 weeks later. In 1976, the experiment was expanded to include 0.28 kg/ha of benomyl, 307.0 ml/ha of thiabendazole, and 0.95 l/ha of chlorothalonil (tetrachloroisopthalonitrile) (Diamond Shamrock) used at the following times: 1. first trifoliate (FTF) leaf stage and again in 4 weeks, 2. FTF and again at early flowering (EF), 3. FTF and again at LFEPS, 4. FTF, LFEPS, and again in 2 weeks, 5. EF and again in 2 weeks, 6. EF, 2 weeks later, and again in 2 weeks, 7. standard recommendation of LFEPS and again in 2 weeks, and 8. FGP and again in 2 weeks. Also in this experiment 0.91 l/ha of captafol (cis-N-[1,1,2-tetrachloroethyl)thio]-4-cyclohexene-1,2,-dicarboximide) (Chevron Chemical) was applied at FTF, LFEPS, and 2 weeks later. There were also three additional treatments with captafol (same rate) applied at FTF and additional applications of either benomyl, thiabendazole, and chlorothalonil at LFEPS and again in 2 weeks at the rates above.

Each timing treatment was rated for disease in 1976 by the petiole method already described. Yields were taken from the two center rows when the plants matured. All yield weights were adjusted to 13% moisture.

In 1975 fungicide screening tests Dare, Curtis and Coker 136 varieties were used. The Coker 136 was located at the Dean Lee Agriculture Center and Curtis and Dare at Burden Research Center. The varieties used in 1976 were Curtis, Dare and Davis. Fungicides were screened on Davis at the Dean Lee Agriculture Center. Treatments used
in these tests appear in Table 1. In 1975 three-row plots were used
and the two left rows were sprayed and harvested when mature. In
1976, four-row plots were sprayed, and the two center rows were har­
vested when mature. Yield weights were adjusted to 13% moisture.
Petioles from all treatments were rated for disease in 1976 by the
method described above.

**Outfield fungicide tests.** Experiments were conducted on private
growers' farms to test methods of application, amounts of water used
in the formulation, and the effect of different geographical and
climatic conditions on yield increases obtained with use of foliar
fungicides. Those tests which involved method of application were
designed to compare yields when the fungicide benomyl was applied with
a hi-boy or airplane. A list of experiments is given in Table 2.

Aerial application was used to compare water volumes of 28.1 l
with 46.8 l/ha. North to south locations for outfield tests provided
a variation in weather conditions for testing climatic conditions on
yields. Plot size varied, but most plots were at least 20 rows wide
and up to 300 m in length. Row width varied on each farm. Similar
untreated plots provided controls. Both control and treated plots
were harvested in four replications from 15-25 m long and two rows
wide when plants were mature. Fungicides were applied to outfield
experiments twice, the first application at LFEPS and the second 2
weeks later.

**Variety tests.** Soybean varieties Hill, Mack, Dare, Forrest, Davis,
Tracy, Curtis, Pickett 71, Lee 74, Bossier, Bragg, and Ransom were
TABLE 1. Fungicides used in screening tests on soybeans in Louisiana, 1975-76.

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Common Name</th>
<th>Chemical Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bay Meb 6447</td>
<td>-</td>
<td>1-(4-Chlorophenoxy)-3,3-dimethyl-1-1(H-1,2,4-triazol-1-yl)-2-butanone</td>
</tr>
<tr>
<td>Benlate</td>
<td>benomyl</td>
<td>methyl-1(butylcarbamoyl)-2-benzimidazolecarbamate</td>
</tr>
<tr>
<td>Bravo 6F</td>
<td>chlorothalonil</td>
<td>Tetrachloroisothalonitrile</td>
</tr>
<tr>
<td>Captan</td>
<td>-</td>
<td>N-((trichloromethyl)thio)-4-cyclohexene-1,2-dicarboximide</td>
</tr>
<tr>
<td>Cyrex</td>
<td>dodine</td>
<td>dodecylguaidine acetate</td>
</tr>
<tr>
<td>Difolatan</td>
<td>captafol</td>
<td>Cis-N-[1,1,2,2-tetrachloroethyl]thio]-4-cyclohexene-1,2-dicarboximide</td>
</tr>
<tr>
<td>Duel</td>
<td>micronized copper sulfur</td>
<td>copper, sulfur</td>
</tr>
<tr>
<td>Du-Ter</td>
<td>fentin hydroxide</td>
<td>triphenyltin hydroxide</td>
</tr>
<tr>
<td>EL-222</td>
<td>-</td>
<td>α-(2-chlorophenyl)-α-(4-chlorophenyl)-5-pyrimidine methanol</td>
</tr>
<tr>
<td>EL-228</td>
<td>-</td>
<td>α-(2-chlorophenyl)-α-(4-fluorophenyl)-5-pyrimidine methanol</td>
</tr>
<tr>
<td>Kocide 4045</td>
<td>-</td>
<td>cupric hydroxide + sulfur</td>
</tr>
<tr>
<td>M-45</td>
<td>maneb + zinc</td>
<td>manganese ethylene bisdithiocarbamate + zinc ion</td>
</tr>
<tr>
<td>Mertect 340F</td>
<td>thiabendazole</td>
<td>2-(4-thiazolyl)benzimidazole</td>
</tr>
<tr>
<td>Mertect 20%S</td>
<td>-</td>
<td>unknown, Merk Chemical Division</td>
</tr>
</tbody>
</table>
### TABLE 1. (Continued)

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Common Name</th>
<th>Chemical Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merk, ME-125</td>
<td></td>
<td>unknown, Merk Chemical Division</td>
</tr>
<tr>
<td>Merk Tecto Flowable</td>
<td></td>
<td>unknown, Merk Chemical Division</td>
</tr>
<tr>
<td>R-28291</td>
<td></td>
<td>0,0-diethyl 2-((3′methoxycarbonyl)-thioureido)-phosphorothioanilide</td>
</tr>
<tr>
<td>RH3928</td>
<td></td>
<td>chemistry confidential, Rohm and Haas Company</td>
</tr>
<tr>
<td>UBI 1172</td>
<td></td>
<td>unknown, Uniroyal Chemical</td>
</tr>
<tr>
<td>Vitavax</td>
<td>carboxin</td>
<td>5,6-dihydro 2-methyl-1,4-oxathiin-3-carboxanilide</td>
</tr>
<tr>
<td>Zinc Omadine</td>
<td></td>
<td>bis(1-hydroxy-2(1H)pyridine-thionato)-zinc</td>
</tr>
</tbody>
</table>
TABLE 2. The location, type of experiment, and variety used for soybean outfield fungicide experiments.

<table>
<thead>
<tr>
<th>Type Experiment</th>
<th>Location</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1975</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>Lake Charles</td>
<td>Lee 68</td>
</tr>
<tr>
<td>A.</td>
<td>Crowley</td>
<td>Davis</td>
</tr>
<tr>
<td>A.</td>
<td>Alexandria</td>
<td>Dare</td>
</tr>
<tr>
<td>A.</td>
<td>Jennings</td>
<td>Dortchsoy</td>
</tr>
<tr>
<td>B.</td>
<td>Lafayette</td>
<td>Forrest</td>
</tr>
<tr>
<td>B.</td>
<td>Alexandria</td>
<td>Dare</td>
</tr>
<tr>
<td>B.</td>
<td>Bossier City</td>
<td>Bragg</td>
</tr>
<tr>
<td>C.</td>
<td>Lake Charles</td>
<td>Lee 68</td>
</tr>
<tr>
<td>C.</td>
<td>Tallulah</td>
<td>Lee 68</td>
</tr>
<tr>
<td>C.</td>
<td>Rosa</td>
<td>Mack</td>
</tr>
<tr>
<td>D.</td>
<td>Cheneyville</td>
<td>Dare</td>
</tr>
<tr>
<td>D.</td>
<td>Erwinville</td>
<td>Ransom</td>
</tr>
<tr>
<td><strong>1976</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.</td>
<td>Krotz Springs</td>
<td>Bragg</td>
</tr>
<tr>
<td>E.</td>
<td>Cheneyville</td>
<td>Dare</td>
</tr>
<tr>
<td>F.</td>
<td>Tallulah</td>
<td>Davis</td>
</tr>
<tr>
<td>F.</td>
<td>Sondhammer</td>
<td>Dare</td>
</tr>
<tr>
<td>G.</td>
<td>Batchelor</td>
<td>Bragg</td>
</tr>
<tr>
<td>A.</td>
<td>Lake Charles</td>
<td>Lee 74</td>
</tr>
<tr>
<td>A.</td>
<td>Crowley</td>
<td>Davis</td>
</tr>
</tbody>
</table>
TABLE 2. (Continued)

<table>
<thead>
<tr>
<th>Type Experiment</th>
<th>Location</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New Roads</td>
<td>Tracy</td>
</tr>
</tbody>
</table>

1976

A. Benomyl at 0.28 kg/ha applied by airplane in 28.1 or 46.8 l/ha.

B. Benomyl at 0.28 kg/ha in 46.8 l of water/ha applied by hi-boy.

C. Thiabendazole at 184.2, 245.6, or 307.0 ml/ha in 46.8 l of water/ha applied by airplane.

D. Benomyl 0.28 kg/ha, thiabendazole 307.0 ml/ha, fentin hydroxide 0.27 kg/ha, chlorothalonil 0.95 l/ha, and maneb 0.45 kg/ha in 160.0 l/ha of water applied by constant-pressure hand sprayer.

E. Benomyl 0.56 and 0.28 kg/ha, thiabendazole 184.2 ml/ha, fentin hydroxide 0.27 kg/ha, chlorothalonil 0.95 l/ha, and benomyl 0.28 kg/ha in combination with thiabendazole, fentin hydroxide, and chlorothalonil at rates given above in 150.0 l/ha of water applied with constant pressure, back-pack sprayer.

F. Benomyl 0.28 kg/ha, chlorothalonil 1.26 l/ha, and fentin hydroxide 0.27 kg/ha in 46.8 l/ha of water applied by airplane.

G. Chlorothalonil 1.26 l/ha applied by airplane in 28.1, 46.8, and 65.5 l of water/ha and by back-pack sprayer in 160.0 l of water/ha plus benomyl 0.28 kg/ha and thiabendazole 184.2 ml/ha in 48.6 l/ha applied by airplane.
planted at the Dean Lee Agriculture Center in eight-row plots with four replications in a completely randomized design within maturity groups. Row spacing was 1.0 m and plot rows were 24.4 m long with 3.0 m alleys. Four rows of each plot were sprayed with two applications of 0.28 kg/ha of benomyl by hi-boy. The first application was when the plants were in the LFEPS stage and the second was 2 weeks later. Four rows of each plot were left untreated. The middle two rows of both the treated and untreated portions of the plots were harvested and the seeds weighed. Yields were adjusted to 13% moisture. Petioles from each treatment were rated for disease as previously described.

In vitro tests for fungicide activity. Fungicides were incorporated into Bacto potato dextrose agar in 9.0 cm petri plates. The concentrations of active ingredient in parts per million were 0, 1.0, 5.0, 10.0, 25.0, 50.0, 100.0, and 500.0. The fungicides used were benomyl, thiabendazole, chlorothalonil, fentin hydroxide, and captafol. The chemical names are listed in Table 1. Each concentration of all fungicides was replicated four times with four plates per concentration for each replication.

The fungi tested were Colletotrichum dematium var. truncata, isolate 7616, and Diaporthe phaseolorum var. sojae, isolate 7617. Inoculation was either on the day the fungicides were incorporated in the agar or 1 day later. Inoculum was a circular plug 0.6 cm in diameter which was cut from a 7-10 day old culture. These discs were placed singly on agar that contained the fungicides at the various
concentrations. Inoculum-containing plates were incubated at room temperature (22-23 C). Colletotrichum dematium var. truncata was incubated under fluorescent light, whereas D. phaseolorum var. sojae was incubated under continuous light from a 20 watt Westinghouse F20T12/BL black light. Growth in diameter was measured 7-9 days after inoculum transfer.

Greenhouse fungicide experiment. Varieties Dare and Davis were planted November 6, 1975 in the greenhouse in a 4:1:1 mixture of soil, sand, and peat moss contained in 25.4 cm clay pots lined with plastic bags. Pots were arranged in 14 rows of four pots per row on each bench. Stands were thinned to five plants per pot about 5 days after emergence. One row was used as one replication. Treatments were randomly distributed within a variety on the two benches. The row on each end of each bench served as a guard row.

The treatments were benomyl, thiabendazole, chlorothalonil, fentin hydroxide plus an untreated control. The fungicide rates were benomyl 0.28 kg/ha, thiabendazole 307.0 ml/ha, chlorothalonil 0.95 l/ha, and fentin hydroxide 0.27 kg/ha applied in about 160.0 l of water/ha, the rates used in field tests. They were applied with an 18.7 l hand-held sprayer with a constant pressure of 2.11 kg/cm² from compressed CO₂. A single No. 8 T-Jet nozzle tip was used. Each fungicide was applied in the LFEPS stage and again 2 weeks later. A portable plywood box was used to enclose each four-pot replication as it was sprayed to prevent drift to other plots. All greenhouse doors and windows were closed during spraying to minimize air movement.
Pods were hand picked and shelled when the plants matured. The number of pods and seed and the seed weight was recorded for each pot.

**Germination tests.** Seeds of selected field fungicide experiments were tested for percent germination. Four replications of 25 randomly selected seed from each treatment were placed on five pieces of filter paper in 9.0 cm petri dishes, 25 seed per dish. Ten ml sterile distilled water was added to each plate and the plates were kept at room temperature. The numbers of germinated seeds were recorded after 5-6 days.

**Percent infection determinations.** Seeds used in the tests for percent germination were observed for the presence of Diaporthe spp. The number of infected seed from each 25-seed replication was recorded. The presence of fruiting bodies of the asexual stage, Phomopsis spp., was used as the criterion for seed infection.
RESULTS

Fungus inoculation tests. In 1975, the mean yields from benomyl-treated plants were significantly higher than the controls (Table 3) in all three varieties tested. There was no significant difference between yields from the plants of any of the other treatments and the controls. The yields from Dare plants that were treated with the combination inoculum and with the combination and anthracnose inoculum were significantly lower than those treated with benomyl. The yields from benomyl-treated Curtis and Bragg plants were significantly higher than those from similar inoculated plants.

Yields from benomyl-treated plants were not significantly better than controls in 1976 (Table 3). No significant differences in yields were found among the treatments involving the Curtis variety. Yields of Bragg plants inoculated with the combination + anthracnose were nearly significantly lower than the control and were significantly lower than the benomyl-treated plants. Bragg and Curtis inoculated with the combination + anthracnose had the lowest yields.

Development of anthracnose and pod and stem blight appeared comparable on all except the benomyl treatments of all varieties. Disease development was somewhat reduced on the benomyl treatments. *Corynespora cassicola* did not develop into a serious problem on foliage and was not severe on pods, although infected pods were
<table>
<thead>
<tr>
<th>Variety</th>
<th>Replication</th>
<th>Control</th>
<th>Benomyl</th>
<th>Anthracnose</th>
<th>Combination</th>
<th>Combination + anthracnose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dare 1975</td>
<td>I</td>
<td>47.3</td>
<td>48.5</td>
<td>38.9</td>
<td>34.8</td>
<td>31.8</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>37.8</td>
<td>41.8</td>
<td>40.5</td>
<td>42.9</td>
<td>49.8</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>17.1</td>
<td>40.1</td>
<td>29.5</td>
<td>25.4</td>
<td>27.1</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>39.9</td>
<td>49.9</td>
<td>47.9</td>
<td>39.3</td>
<td>36.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>35.6</td>
<td>45.1*</td>
<td>39.2</td>
<td>35.6</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% = 8.8</td>
<td>1% = 12.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curtis 1975</td>
<td>I</td>
<td>36.4</td>
<td>52.4</td>
<td>33.9</td>
<td>35.7</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>34.4</td>
<td>64.3</td>
<td>38.4</td>
<td>38.9</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>42.4</td>
<td>56.8</td>
<td>38.9</td>
<td>43.8</td>
<td>46.4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>39.4</td>
<td>55.3</td>
<td>35.9</td>
<td>41.8</td>
<td>35.4</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>38.1</td>
<td>57.2**</td>
<td>36.8</td>
<td>40.1</td>
<td>38.6</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% = 13.4</td>
<td>1% = 18.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bragg 1975</td>
<td>I</td>
<td>35.4</td>
<td>54.9</td>
<td>40.9</td>
<td>37.9</td>
<td>44.4</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>45.4</td>
<td>47.9</td>
<td>34.9</td>
<td>35.4</td>
<td>38.9</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>44.9</td>
<td>54.9</td>
<td>48.4</td>
<td>49.9</td>
<td>40.9</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>45.8</td>
<td>54.4</td>
<td>51.3</td>
<td>46.9</td>
<td>49.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>42.9</td>
<td>53.0</td>
<td>43.8</td>
<td>42.5</td>
<td>43.5</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% = 8.4</td>
<td>1% = 11.6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 3. (Continued)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Replication</th>
<th>Control</th>
<th>Benomyl</th>
<th>Anthracnose</th>
<th>Combination</th>
<th>Combination + anthracnose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curtis 1976</td>
<td>I</td>
<td>34.5</td>
<td>26.6</td>
<td>34.6</td>
<td>39.3</td>
<td>32.6</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>37.8</td>
<td>28.2</td>
<td>32.2</td>
<td>44.0</td>
<td>22.0</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>31.4</td>
<td>39.3</td>
<td>41.7</td>
<td>33.0</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>36.4</td>
<td>48.8</td>
<td>32.7</td>
<td>33.9</td>
<td>45.2</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>35.0</td>
<td>35.8</td>
<td>35.3</td>
<td>37.6</td>
<td>33.1</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% = 10.3</td>
<td>1% = 13.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bragg 1976</td>
<td>I</td>
<td>50.5</td>
<td>47.1</td>
<td>37.4</td>
<td>49.2</td>
<td>48.5</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>49.3</td>
<td>56.6</td>
<td>50.1</td>
<td>46.3</td>
<td>40.2</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>50.7</td>
<td>45.6</td>
<td>49.8</td>
<td>45.4</td>
<td>48.2</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>50.1</td>
<td>56.7</td>
<td>53.4</td>
<td>47.4</td>
<td>38.6</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>50.2</td>
<td>51.5</td>
<td>47.7</td>
<td>47.1</td>
<td>43.8</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% = 6.9</td>
<td>1% = 9.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Denotes significance at 1% level.

*Denotes significance at 5% level.
found. In 1975, frogeye leaf spot caused by *C. sojina* caused severe leaf spotting on Curtis with the exception of benomyl-treated plots. Bragg was less severely infected than Curtis but more than Dare. Soybean plants not involved in inoculation or fungicide tests were severely infected by *C. sojina* which indicated that abundant natural inoculum was present. The fungus caused only mild infection during 1976. Because lesions did not appear until past mid-season, it never became a serious problem.

In 1975, the application of benomyl caused the harvest of Curtis to be delayed 10–12 days and Bragg and Dare 7–9 days. Similarly, in 1976, harvest of Curtis was delayed 7 days and Bragg 5–6 days (Fig. 4).

**Fungicide timing tests.** The timing experiment in 1975 showed that the yields of Curtis plants sprayed with benomyl were significantly higher than the controls in all four timing applications. Yields were significantly higher than the controls when fentin hydroxide was applied at LFEPS + 2 weeks, FGP and FGP + 2 weeks. When thiabendazole was used, significant yield increases were obtained over the controls with the FGP + 2 weeks treatment only. These data are given in Table 4.

Application to Bragg with benomyl at LFEPS, LFEPS + 2 weeks, and FGP + 2 weeks increased yields significantly (Table 5). There were no significant differences in yields of Bragg sprayed with fentin hydroxide or thiabendazole and the controls. The yields from timing treatments which involved a second application were higher than the yields of single-application treatments of benomyl and fentin hydroxide on Bragg and Curtis. Although the FGP + 2 weeks treatment with
Fig. 4. Curtis soybean plants. Benomyl-treated plants showing delayed maturity are on the left. Plants on the right are untreated.
TABLE 4. Yields in hl/ha of Curtis soybeans sprayed with 0.28 kg/ha of benomyl, 0.54 kg/ha of fentin hydroxide, or 184.2 ml/ha of thia­bendazole at the Burden Research Farm, Baton Rouge, Louisiana, 1975, at four timing sequences.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Replication</th>
<th>Benomyl</th>
<th>Fentin hydroxide</th>
<th>Thiabendazole</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1</td>
<td>I</td>
<td>37.4</td>
<td>17.4</td>
<td>21.4</td>
<td>18.4</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>18.4</td>
<td>13.5</td>
<td>19.5</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>15.0</td>
<td>6.5</td>
<td>13.5</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>23.9</td>
<td>10.0</td>
<td>13.0</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>23.7**</td>
<td>11.8</td>
<td>16.9</td>
<td>16.5</td>
</tr>
</tbody>
</table>

| B. 2   | I           | 28.4    | 18.4            | 14.4          | 19.0    |
|        | II          | 32.5    | 23.9            | 19.5          | 11.0    |
|        | III         | 21.4    | 15.9            | 13.5          | 13.9    |
|        | IV          | 22.4    | 15.0            | 16.4          | 17.5    |
|        | X           | 26.2**  | 18.4*           | 16.0          | 15.3    |

| C. 3   | I           | 20.4    | 18.4            | 18.4          | 14.4    |
|        | II          | 15.0    | 16.4            | 17.5          | 11.5    |
|        | III         | 16.4    | 13.9            | 16.4          | 11.0    |
|        | IV          | 13.5    | 17.5            | 11.0          | 17.5    |
|        | X           | 16.4*   | 16.6*           | 15.8          | 13.6    |

| D. 4   | I           | 20.4    | 19.0            | 25.9          | 15.5    |
|        | II          | 16.4    | 15.0            | 21.0          | 13.9    |
|        | III         | 13.5    | 16.4            | 13.9          | 17.5    |
|        | IV          | 21.9    | 21.0            | 13.5          | 12.4    |
|        | X           | 18.1*   | 17.8            | 18.6**        | 14.9    |

LSD 5%=2.35  
1%=3.12

1 One application at late flowering to early pod set.  
2 One application at late flowering to early pod set and one application 2 weeks later.  
3 One application at full green pod.
| TABLE 4. (Continued) |

4One application at full green pod and one application 2 weeks later.

**Denotes significance at 1% level.

*Denotes significance at 5% level.
TABLE 5. Yields in hl/ha of Bragg soybeans sprayed with 0.28 kg/ha of benomyl, 0.54 kg/ha of fentin hydroxide, or 184.2 ml/ha of thiabendazole at the Burden Research Farm, Baton Rouge, Louisiana, 1975, at four timing sequences.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Replication</th>
<th>Benomyl</th>
<th>Fentin hydroxide</th>
<th>Thiabendazole</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.¹</td>
<td>I</td>
<td>45.8</td>
<td>35.4</td>
<td>32.8</td>
<td>27.9</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>35.9</td>
<td>34.5</td>
<td>35.4</td>
<td>34.4</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>29.9</td>
<td>27.0</td>
<td>30.9</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>36.8</td>
<td>34.9</td>
<td>32.9</td>
<td>23.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>37.1**</td>
<td>33.0</td>
<td>32.9</td>
<td>29.1</td>
</tr>
<tr>
<td>B. ²</td>
<td>I</td>
<td>44.4</td>
<td>23.0</td>
<td>40.9</td>
<td>24.4</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>31.4</td>
<td>35.9</td>
<td>35.9</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>41.4</td>
<td>19.5</td>
<td>29.9</td>
<td>25.4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>36.4</td>
<td>29.4</td>
<td>25.0</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>38.4**</td>
<td>27.0</td>
<td>33.0</td>
<td>27.9</td>
</tr>
<tr>
<td>C. ³</td>
<td>I</td>
<td>24.4</td>
<td>34.5</td>
<td>36.9</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>27.4</td>
<td>32.5</td>
<td>24.4</td>
<td>20.4</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>32.5</td>
<td>21.5</td>
<td>32.5</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>28.4</td>
<td>21.9</td>
<td>30.9</td>
<td>31.4</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>28.2</td>
<td>27.6</td>
<td>31.1</td>
<td>30.4</td>
</tr>
<tr>
<td>D. ⁴</td>
<td>I</td>
<td>38.9</td>
<td>39.4</td>
<td>38.4</td>
<td>38.9</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>34.5</td>
<td>30.5</td>
<td>39.0</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>29.4</td>
<td>29.6</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>37.4</td>
<td>38.9</td>
<td>33.4</td>
<td>28.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>35.1*</td>
<td>34.6</td>
<td>33.9</td>
<td>29.8</td>
</tr>
</tbody>
</table>

LSD 5%=5.60
1%=7.46

¹One application at late flowering to early pod set.

²One application at late flowering to early pod set and one application 2 weeks later.

³One application at full green pod.
TABLE 5. (Continued)

4 One application at full green pod and one application 2 weeks later.

** Denotes significance at 1% level.

* Denotes significance at 5% level.
thiabendazole on both varieties produced similar results, the in­
creases were not all significant. The yields of Bragg and Curtis
plants treated at LFEPS + 2 weeks with benomyl were higher than the
yields of the controls, however, the reverse was true when the fungi­
cide thiabendazole was applied to the same varieties at the later
timing of FGP + 2 weeks. When fentin hydroxide was applied to Curtis
at LFEPS + 2 weeks the yields were higher than those when the same
fungicide was sprayed at FGP + 2 weeks, but the opposite was true with
the Bragg variety.

In the 1976 timing test the yields of Curtis in general were high­
est when the fungicides were applied either at LFEPS + 2 weeks or EF +
2 weeks (Table 6). The yields from all treatments with benomyl that
included the sequence of LFEPS + 2 weeks were significantly more than
the control. The yields from the benomyl at EF + 2 weeks, from the
chlorothalonil treatments at LFEPS + 2 weeks and EF + 2 weeks, and
from the thiabendazole treatments at EF + 2 weeks + 2 weeks, EF +
2 weeks, LFEPS + 2 weeks, FTF + LFEPS, and FTF + EF were significantly
higher than the controls. Yields from treatments of thiabendazole
applied at FTF + LFEPS + 2 weeks, captafol at FTF, LFEPS + 2 weeks and
chlorothalonil at FGP + 2 weeks were not significantly higher than the
non-treated control, however, the yields from these same treatments
were not significantly less than those in the experiment which were
significantly better than the control.

Significant differences were not obtained between the yields of
Dare in any treatments of the timing test in 1976 (Table 7). However,

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Replication</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Timing1</td>
<td>I</td>
</tr>
<tr>
<td>Benomyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>44.4</td>
<td>42.6</td>
</tr>
<tr>
<td>2</td>
<td>37.9</td>
<td>46.5</td>
</tr>
<tr>
<td>3</td>
<td>37.7</td>
<td>36.2</td>
</tr>
<tr>
<td>4</td>
<td>45.2</td>
<td>41.1</td>
</tr>
<tr>
<td>5</td>
<td>48.8</td>
<td>45.8</td>
</tr>
<tr>
<td>6</td>
<td>47.2</td>
<td>37.4</td>
</tr>
<tr>
<td>7</td>
<td>47.4</td>
<td>45.2</td>
</tr>
<tr>
<td>8</td>
<td>37.1</td>
<td>45.2</td>
</tr>
<tr>
<td>Thiabendazole3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>44.7</td>
<td>43.2</td>
</tr>
<tr>
<td>2</td>
<td>43.6</td>
<td>47.2</td>
</tr>
<tr>
<td>3</td>
<td>48.0</td>
<td>41.6</td>
</tr>
<tr>
<td>4</td>
<td>42.6</td>
<td>45.5</td>
</tr>
<tr>
<td>5</td>
<td>44.4</td>
<td>42.9</td>
</tr>
<tr>
<td>6</td>
<td>45.7</td>
<td>48.1</td>
</tr>
<tr>
<td>7</td>
<td>46.2</td>
<td>41.2</td>
</tr>
<tr>
<td>8</td>
<td>40.4</td>
<td>37.7</td>
</tr>
<tr>
<td>Chlorothalonil4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>42.5</td>
<td>39.5</td>
</tr>
<tr>
<td>2</td>
<td>35.4</td>
<td>31.3</td>
</tr>
<tr>
<td>3</td>
<td>44.6</td>
<td>39.9</td>
</tr>
<tr>
<td>4</td>
<td>46.1</td>
<td>38.9</td>
</tr>
<tr>
<td>5</td>
<td>43.2</td>
<td>48.4</td>
</tr>
<tr>
<td>6</td>
<td>47.5</td>
<td>45.9</td>
</tr>
<tr>
<td>7</td>
<td>43.6</td>
<td>45.2</td>
</tr>
<tr>
<td>8</td>
<td>45.0</td>
<td>44.2</td>
</tr>
<tr>
<td>Captafol5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>41.2</td>
<td>45.7</td>
</tr>
<tr>
<td>Captafol and Benomyl</td>
<td></td>
<td>51.2</td>
</tr>
<tr>
<td>Captafol and Thiabendazole</td>
<td></td>
<td>37.4</td>
</tr>
<tr>
<td>Captafol and Chlorothalonil</td>
<td></td>
<td>46.5</td>
</tr>
</tbody>
</table>
TABLE 6. (Continued)

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Timing&lt;sup&gt;1&lt;/sup&gt;</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td>33.1</td>
<td>40.3</td>
<td>41.8</td>
<td>43.5</td>
<td>39.7</td>
</tr>
<tr>
<td>LSD 5%=5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% =7.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup>Timing Applications
1 - first trifoliate leaf stage (FTF) and 4 weeks later
2 - FTF and at early flowering (EF)
3 - FTF and at late flowering, early pod set (LFEPS)
4 - FTF, LFEPS, and 2 weeks later
5 - EF and 2 weeks later
6 - EF, 2 weeks later, and 2 weeks later
7 - LFEPS and 2 weeks later
8 - full green pod (FGP) and 2 weeks later
10 - Captafol at FTF, either benomyl, thiabendazole, or chlorothalonil at LFEPS and 2 weeks later

<sup>2</sup>Benomyl - 0.28 kg/ha active ingredient (a.i.) per application.

<sup>3</sup>Thiabendazole - 184.2 ml/ha a. i. per application.

<sup>4</sup>Chlorothalonil - 0.95 l/ha a. i. per application.

<sup>5</sup>Captafol - 0.91 l/ha a. i. per application.

**Denotes significance at 1% level.
*Denotes significance at 5% level.
TABLE 7. Yields (hl/ha) of Dare soybeans sprayed with benomyl, thiabendazole, chlorothalonil, or captafol at different timing sequences. Burden Research Farm, Baton Rouge, Louisiana, 1976.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Timing&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Replication</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benomyl&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1</td>
<td></td>
<td>40.6</td>
<td>36.7</td>
<td>51.7</td>
<td>38.3</td>
<td>41.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>49.8</td>
<td>34.7</td>
<td>41.1</td>
<td>50.9</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td>35.5</td>
<td>36.7</td>
<td>47.4</td>
<td>52.5</td>
<td>43.1</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>39.6</td>
<td>38.3</td>
<td>47.8</td>
<td>47.0</td>
<td>43.2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>41.1</td>
<td>41.4</td>
<td>48.2</td>
<td>50.5</td>
<td>45.3</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>43.8</td>
<td>40.6</td>
<td>48.5</td>
<td>42.6</td>
<td>43.9</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td>37.5</td>
<td>36.7</td>
<td>50.5</td>
<td>52.1</td>
<td>44.2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td>39.8</td>
<td>39.6</td>
<td>50.1</td>
<td>51.3</td>
<td>45.2</td>
</tr>
<tr>
<td>Thiabendazole&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1</td>
<td></td>
<td>39.5</td>
<td>34.4</td>
<td>47.4</td>
<td>45.4</td>
<td>41.7</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>40.3</td>
<td>35.5</td>
<td>49.3</td>
<td>47.8</td>
<td>43.2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td>34.7</td>
<td>37.9</td>
<td>41.1</td>
<td>43.1</td>
<td>39.3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>37.5</td>
<td>41.1</td>
<td>50.5</td>
<td>48.5</td>
<td>44.5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>47.4</td>
<td>35.9</td>
<td>47.0</td>
<td>29.2</td>
<td>39.9</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>37.5</td>
<td>35.5</td>
<td>44.6</td>
<td>49.8</td>
<td>41.8</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td>39.8</td>
<td>39.1</td>
<td>46.5</td>
<td>39.1</td>
<td>42.0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td>38.3</td>
<td>32.8</td>
<td>41.8</td>
<td>45.8</td>
<td>39.7</td>
</tr>
<tr>
<td>Chlorothalonil&lt;sup&gt;4&lt;/sup&gt;</td>
<td>1</td>
<td></td>
<td>39.5</td>
<td>31.6</td>
<td>51.7</td>
<td>49.3</td>
<td>43.1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>36.2</td>
<td>35.5</td>
<td>46.2</td>
<td>45.8</td>
<td>41.0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td>37.5</td>
<td>40.6</td>
<td>43.8</td>
<td>38.7</td>
<td>40.2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>35.5</td>
<td>37.9</td>
<td>49.8</td>
<td>39.5</td>
<td>40.7</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>31.2</td>
<td>39.5</td>
<td>49.8</td>
<td>39.5</td>
<td>40.0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>41.1</td>
<td>37.1</td>
<td>48.2</td>
<td>49.3</td>
<td>43.9</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td>39.1</td>
<td>35.9</td>
<td>47.0</td>
<td>51.3</td>
<td>43.3</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td>37.5</td>
<td>41.1</td>
<td>45.8</td>
<td>47.0</td>
<td>42.8</td>
</tr>
<tr>
<td>Captafol&lt;sup&gt;5&lt;/sup&gt;</td>
<td>4</td>
<td></td>
<td>43.8</td>
<td>35.9</td>
<td>46.2</td>
<td>45.0</td>
<td>42.7</td>
</tr>
<tr>
<td>Captafol and Benomyl</td>
<td>10</td>
<td></td>
<td>37.9</td>
<td>36.7</td>
<td>45.0</td>
<td>53.3</td>
<td>43.3</td>
</tr>
<tr>
<td>Captafol and Thiabendazole</td>
<td>10</td>
<td></td>
<td>40.3</td>
<td>37.9</td>
<td>51.3</td>
<td>42.6</td>
<td>43.1</td>
</tr>
<tr>
<td>Captafol and Chlorothalonil</td>
<td>10</td>
<td></td>
<td>39.5</td>
<td>36.3</td>
<td>45.4</td>
<td>49.3</td>
<td>42.6</td>
</tr>
</tbody>
</table>
### TABLE 7. (Continued)

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Timing&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Replication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LSD 5% = 8.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% = 11.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Timing Application 1 - first trifoliate leaf state (FTF) and 2 weeks later  
2 - FTF and at early flowering (EF)  
3 - FTF and at late flowering, early pod set (LFEPS)  
4 - FTF, LFEPS, and 2 weeks later  
5 - EF and 2 weeks later  
6 - EF, 2 weeks later, and 2 weeks later  
7 - LFEPS and 2 weeks later  
8 - full green pod (FGP) and 2 weeks later  
10 - Captafol at FTF, either benomyl, thiabendazole, or chlorothalonil at LFEPS and 2 weeks later

<sup>2</sup> Benomyl - 0.28 kg/ha active ingredient (a.i.) per application.  
<sup>3</sup> Thiabendazole - 184.2 ml/ha a. i. per application.  
<sup>4</sup> Chlorothalonil - 0.95 l/ha a. i. per application.  
<sup>5</sup> Captafol - 0.91 l/ha a. i. per application.  
**Denotes significance at 1% level.  
* Denotes significance at 5% level.
in general, the yields of all varieties which were sprayed with fungicides at LFEPS + 2 weeks were the highest.

**Fungicide screening tests.** There was no significance between yields of plots of any treatments of the fungicide screening test on Dare in 1975. Bravo 6F, RH3928+M-45, and Vitavax yields were the highest. On Curtis, in 1975, yields from plots treated with Benlate 50W, Du-Ter + Benlate 50W, RH3928, and RH3928+M-45 were higher than the control. Yields from Coker 136 plots in 1975 treated with Bravo 6F, Duel, Mertect 340F at 0.44 l/ha, Mertect 340F at 0.44 l/ha + Benlate 50W, Benlate 50W + Bravo 6F, Duel at 2.80 kg/ha + Benlate 50W, Duel at 5.60 kg/ha + Benlate 50W, Duel at 2.80 kg/ha + Bravo 6F, and Duel at 5.60 kg/ha + Bravo 6F were significantly greater than the control.

The 1975 data are found in Table 8. The yield from the plot treated with Mertect 340F at 0.73 l/ha was the only one significantly better than the control on Curtis in 1976. Plots treated with Benlate 50W in combination with Captan 80W at 3.36 kg/ha, Du-Ter, and Mertect 340F at 0.44 l/ha, as well as Mertect 340F at 0.73 l/ha, had significantly higher yields than the control on Dare in 1976. Yields of plots treated with Benlate 50W + either Bravo 6F or Difolatan 4F were significantly greater than the control on Davis in 1976. These data appear in Table 9.

**Outfield fungicide tests.** In experiments to determine the efficacy of benomyl in formulations of 28.1 and 46.8 l of water/ha (Table 10), yields from plants sprayed with the 46.8 l formulation applied by
TABLE 8. Yields\(^a\) in hl/ha of Curtis, Dare and Coker 136 soybean varieties treated\(^b\) with fungicides in fungicide screening experiments in Louisiana, 1975.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Rate/ha</th>
<th>YIELD</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dare(^d)</td>
<td>Curtis(^d)</td>
<td>Coker 136(^d)</td>
<td></td>
</tr>
<tr>
<td>Bay Meb 6447</td>
<td>1.12 kg</td>
<td>33.6</td>
<td>18.2</td>
<td>NT(^c)</td>
<td></td>
</tr>
<tr>
<td>Benlate 50W</td>
<td>0.56 kg</td>
<td>32.2</td>
<td>23.7**</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Bravo 6F</td>
<td>1.75 l</td>
<td>40.5</td>
<td>17.7</td>
<td>39.2**</td>
<td></td>
</tr>
<tr>
<td>Cyprex</td>
<td>1.12 kg</td>
<td>36.8</td>
<td>17.2</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>Duel</td>
<td>2.80 kg</td>
<td>35.3</td>
<td>20.6</td>
<td>35.9**</td>
<td></td>
</tr>
<tr>
<td>Du-Ter + Benlate</td>
<td>0.56 kg + 0.56 kg</td>
<td>35.9</td>
<td>20.9*</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Kocide 404S</td>
<td>5.04 kg</td>
<td>25.6</td>
<td>14.7</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>Mertect 340F</td>
<td>0.73 l</td>
<td>35.1</td>
<td>18.7</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>Mertect 340F</td>
<td>0.44 l</td>
<td>35.4</td>
<td>17.5</td>
<td>35.8**</td>
<td></td>
</tr>
<tr>
<td>R-28291</td>
<td>1.12 kg</td>
<td>37.4</td>
<td>20.2</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>RH3928</td>
<td>146.2 ml</td>
<td>33.1</td>
<td>20.7*</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>RH3928 + M-45</td>
<td>146.2 ml + 1.12 kg</td>
<td>39.4</td>
<td>23.8**</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>Vitavax</td>
<td>3.36 kg</td>
<td>39.2</td>
<td>15.7</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>Zinc Omadine</td>
<td>1.12 kg</td>
<td>31.9</td>
<td>16.4</td>
<td>NT</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>33.1</td>
<td>16.7</td>
<td>30.7</td>
<td></td>
</tr>
</tbody>
</table>

LSD 5\%=10.67  LSD 5\%=3.93  
1\%=14.15  1\%=5.20

Mertect 340F + Benlate  
Benlate + Bravo 6F  
Duel + Benlate

0.44 l + 0.56 kg  
0.56 kg + 1.75 l  
2.80 kg + 0.56 kg

40.9**  
37.9**  
35.6**
TABLE 8. (Continued)

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Rate/ha</th>
<th>YIELD</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dare&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Curtis&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Coker 136&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Duel + Benlate</td>
<td>5.60 kg + 0.56 kg</td>
<td>37.7&lt;sup&gt;**&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duel + Bravo</td>
<td>2.80 kg + 1.17 l</td>
<td>34.5&lt;sup&gt;**&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duel + Bravo</td>
<td>5.60 kg + 1.17 l</td>
<td>36.6&lt;sup&gt;**&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duel + Du-Ter</td>
<td>2.80 kg + 0.56 kg</td>
<td>32.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duel + Du-Ter</td>
<td>0.56 kg + 0.56 kg</td>
<td>30.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD 5% = 3.05</td>
<td>1% = 4.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Mean of four replications/treatment.

<sup>b</sup>Two applications, first at late flowering to early pod set, second 2 weeks later.

<sup>c</sup>CNT - no treatment for this variety.

<sup>d</sup>Burden Research Farm, Baton Rouge.

<sup>e</sup>Dean Lee Agriculture Center, Alexandria.

**Denotes significance at 1% level.

*Denotes significance at 5% level.
TABLE 9. Yields\textsuperscript{a} in hl/ha of Curtis, Dare and Davis soybean varieties treated\textsuperscript{b} with fungicides in fungicide screening experiments in Louisiana, 1976.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Rate/ha</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Curtis\textsuperscript{d}</td>
</tr>
<tr>
<td>Bay Meb 6447</td>
<td>1.12 kg</td>
<td>51.5</td>
</tr>
<tr>
<td>Benlate 50W</td>
<td>0.56 kg</td>
<td>50.4</td>
</tr>
<tr>
<td>Bravo 6F</td>
<td>1.75 l</td>
<td>47.4</td>
</tr>
<tr>
<td>Captan 80W</td>
<td>4.48 kg</td>
<td>50.0</td>
</tr>
<tr>
<td>Captan 80W</td>
<td>3.36 kg</td>
<td>46.0</td>
</tr>
<tr>
<td>Difolaton 4F</td>
<td>2.34 l</td>
<td>49.2</td>
</tr>
<tr>
<td>Du-Ter</td>
<td>0.56 kg</td>
<td>51.3</td>
</tr>
<tr>
<td>EL-222</td>
<td>0.33 l</td>
<td>49.7</td>
</tr>
<tr>
<td>EL-228</td>
<td>0.66 l</td>
<td>49.5</td>
</tr>
<tr>
<td>Mertect 340F</td>
<td>0.73 l</td>
<td>55.8*</td>
</tr>
<tr>
<td>Mertect 340F</td>
<td>0.58 l</td>
<td>51.8</td>
</tr>
<tr>
<td>Mertect 340F</td>
<td>0.44 l</td>
<td>48.1</td>
</tr>
<tr>
<td>Mertect 20S</td>
<td>0.58 l</td>
<td>54.3</td>
</tr>
<tr>
<td>Merk Tecto Flowable</td>
<td>1.17 l</td>
<td>52.7</td>
</tr>
<tr>
<td>UBI 1172</td>
<td>1.75 l</td>
<td>49.0</td>
</tr>
<tr>
<td>Benlate 50W +</td>
<td>0.56 kg</td>
<td>51.9</td>
</tr>
<tr>
<td>Bravo 6F</td>
<td>1.75 l</td>
<td></td>
</tr>
<tr>
<td>Benlate 50W +</td>
<td>0.56 kg</td>
<td>50.0</td>
</tr>
<tr>
<td>Captan 80W</td>
<td>4.48 kg</td>
<td></td>
</tr>
<tr>
<td>Benlate 50W +</td>
<td>0.56 kg</td>
<td>53.2</td>
</tr>
<tr>
<td>Captan 80W</td>
<td>3.36 kg</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 9. (Continued)

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Rate/ha</th>
<th>Yield</th>
<th>Curtis&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Dare&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Davis&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benlate 50W + Difolatan 4F</td>
<td>0.56 kg + 2.34 l</td>
<td>51.9</td>
<td>44.7</td>
<td>58.9*</td>
<td></td>
</tr>
<tr>
<td>Benlate 50W + Du-Ter</td>
<td>0.56 kg + 0.56 kg</td>
<td>54.6</td>
<td>47.4*</td>
<td>54.2</td>
<td></td>
</tr>
<tr>
<td>Benlate 50W + Mertect 340F</td>
<td>0.56 kg + 0.44 l</td>
<td>52.4</td>
<td>46.8*</td>
<td>55.9</td>
<td></td>
</tr>
<tr>
<td>Bravo 6F + Difolatan 4F</td>
<td>1.75 l + 2.34 l</td>
<td>49.9</td>
<td>41.6</td>
<td>57.2</td>
<td></td>
</tr>
<tr>
<td>Bravo 6F + Du-Ter</td>
<td>1.75 l + 0.56 kg</td>
<td>52.3</td>
<td>46.4</td>
<td>58.0</td>
<td></td>
</tr>
<tr>
<td>Bravo 6F + Mertect 340F</td>
<td>1.75 l + 0.44 l</td>
<td>49.9</td>
<td>45.5</td>
<td>54.5</td>
<td></td>
</tr>
<tr>
<td>Difolatan 4F + Mertect 340F</td>
<td>2.34 L + 0.44 l</td>
<td>52.1</td>
<td>43.4</td>
<td>57.5</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>48.7</td>
<td>41.6</td>
<td>53.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LSD 5%=6.09 LSD 5%=5.13 LSD 5%=4.70
1%=8.00 1%=6.87 1%=6.26

<sup>a</sup>Mean of four replications/treatment.

<sup>b</sup>Two applications, first at late flower to early pod set, second 2 weeks later.

<sup>c</sup>NT - no treatment for this variety.

<sup>d</sup>Burden Research Farm, Baton Rouge.

<sup>e</sup>Dean Lee Agriculture Center, Alexandria.

**Denotes significance at 1% level.

*Denotes significance at 5% level.
TABLE 10. Mean\textsuperscript{a} yields in hl/ha of soybean varieties sprayed twice\textsuperscript{b} by airplane with 0.28 kg/ha benomyl in 28.1 or 46.8 l/ha of water. All locations are in Louisiana.

<table>
<thead>
<tr>
<th>Location</th>
<th>Variety</th>
<th>46.8 l</th>
<th>28.1 l</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40.4</td>
<td>38.6</td>
<td>35.9</td>
</tr>
<tr>
<td>Lake Charles</td>
<td>Lee 68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =4.64</td>
<td>1%=6.34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5%=4.64</td>
<td>1%=6.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crowley</td>
<td>Davis</td>
<td>34.8*</td>
<td>35.7*</td>
<td>30.3</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =3.45</td>
<td>1%=5.02</td>
<td></td>
</tr>
<tr>
<td>Alexandria</td>
<td>Dare</td>
<td>43.7**</td>
<td>41.8*</td>
<td>37.9</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =2.42</td>
<td>1%=4.00</td>
<td></td>
</tr>
<tr>
<td>Jennings</td>
<td>Dortchsoy</td>
<td>32.0*</td>
<td>31.0</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =4.40</td>
<td>1%=6.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40.5**</td>
<td>34.3</td>
<td>33.3</td>
</tr>
<tr>
<td>Lake Charles</td>
<td>Lee 74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =4.10</td>
<td>1%=5.79</td>
<td></td>
</tr>
<tr>
<td>Crowley</td>
<td>Davis</td>
<td>47.3**</td>
<td>34.3</td>
<td>34.4</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =5.25</td>
<td>1%=7.41</td>
<td></td>
</tr>
<tr>
<td>New Roads</td>
<td>Tracy</td>
<td>54.3**</td>
<td>50.8</td>
<td>50.1</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>5% =2.93</td>
<td>1%=4.14</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Four replications/treatment.  

\textsuperscript{b}First application at late flowering, early pod set, second application 2 weeks later.  

**Denotes significance at 1% level.  

*Denotes significance at 5% level.
airplane were significantly higher than the yields of the controls in six of seven tests over a 2-year period. The control yields were always less than yields of the 46.8 l formulation and were significantly less than the 28.1 l formulation in two of seven tests. The yields from plants sprayed with the 46.8 l formulation were greater than those from the 28.1 l formulation in all but one test and were significantly greater in all the 1976 tests.

Yields from benomyl-treated plots where the fungicide was applied by hi-boy (Table 11) were significantly higher than control yields in two of three experiments. In the third test the control yield was slightly more than the yield from treated plots.

Yields from plants treated with the 245.6 ml rate of thiabendazole were significantly higher than yields of controls and higher than yields of the 307.0 ml rate of thiabendazole when compared in the same test (Table 12). When the 184.2 ml rate, 245.6 ml rate, and control were compared in one experiment the lower rate yields were significantly greater than the higher rate and the control. There was little difference between the 245.6 ml rate and the control. A third experiment compared the 184.2 ml rate and a control and the 307.0 ml rate and a control. Yield from the 184.2 ml rate treatment was significantly greater than yield from the control. The yield from plots receiving the 307.0 ml rate did not differ significantly from the control.

Chlorothalonil was applied to soybeans in 28.1, 46.8, 65.5 and 160.0 l of water/ha (Table 13). Yields were as follows: 45.5, 42.6,
TABLE 11. Mean\(^a\) yields in hl/ha of soybeans treated with two applications\(^b\) of 0.28 kg/ha of benomyl applied with a hi-boy in Louisiana, 1975.

<table>
<thead>
<tr>
<th>Location</th>
<th>Variety</th>
<th>Benomyl Treated</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lafayette</td>
<td>Forrest</td>
<td>46.6**</td>
<td>36.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD 5%=5.78</td>
<td>1%=7.73</td>
</tr>
<tr>
<td>Alexandria</td>
<td>Dare</td>
<td>49.2**</td>
<td>43.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD 5%=3.06</td>
<td>1%=4.33</td>
</tr>
<tr>
<td>Bossier City</td>
<td>Bragg</td>
<td>48.8</td>
<td>49.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD 5%=1.84</td>
<td>1%=3.93</td>
</tr>
</tbody>
</table>

\(^a\)Four replications per treatment.

\(^b\)First at late flowering, early pod set, second 2 weeks later.

**Denotes significance at 1% level.
TABLE 12. Mean\textsuperscript{a} yields of soybeans treated\textsuperscript{b} with different rates of thiabendazole, Louisiana, 1975.

<table>
<thead>
<tr>
<th>Location</th>
<th>Variety</th>
<th>184.2 ml/ha</th>
<th>245.6 ml/ha</th>
<th>307.0 ml/ha</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Charles</td>
<td>Lee 68</td>
<td>41.7*</td>
<td>39.7</td>
<td>35.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD 5%=4.64</td>
<td>1%=6.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tallulah</td>
<td>Lee 68</td>
<td>37.7**</td>
<td>32.8</td>
<td>32.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD 5%=2.71</td>
<td>1%=3.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosa</td>
<td>Mack</td>
<td>36.5**</td>
<td>29.9\textsuperscript{c}</td>
<td>38.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD 5%=2.78</td>
<td>1%=3.90</td>
<td>37.8</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Four replications per treatment.

\textsuperscript{b}Two applications; first at late flower, early pod set, second 2 weeks later.

\textsuperscript{c}Value for control plots harvested next to 184.2 ml treated plots. Distance in field between 307.0 ml and 184.2 ml treatments too great to compare same control plots to both treatments.

\textsuperscript{**}Denotes significance at 1\% level.

\textsuperscript{*}Denotes significance at 5\% level.
TABLE 13. Mean yields of four replications per treatment of Bragg soybeans at Batchelor, Louisiana, 1976, treated\textsuperscript{a} with 1.26 l/ha of chlorothalonil in different amounts of water/ha and 0.28 kg/ha of benomyl and 184.2 ml/ha of thiabendazole in 46.8 l/ha of water.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (hl/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorothalonil</td>
<td></td>
</tr>
<tr>
<td>28.1 l/ha</td>
<td>45.5**</td>
</tr>
<tr>
<td>46.8 l/ha</td>
<td>42.6</td>
</tr>
<tr>
<td>65.5 l/ha\textsuperscript{b}</td>
<td>44.5**</td>
</tr>
<tr>
<td>160.0 l/ha</td>
<td>39.5</td>
</tr>
<tr>
<td>Benomyl</td>
<td>43.6*</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>44.7**</td>
</tr>
<tr>
<td>Control</td>
<td>38.7</td>
</tr>
<tr>
<td>LSD 5%=4.21</td>
<td></td>
</tr>
<tr>
<td>1%=5.56</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Two applications; first at late flowering, early pod set, second 2 weeks later.

\textsuperscript{b}Applied by hand-held sprayer, all others applied by airplane.

**Denotes significance at 1% level.

*Denotes significance at 5% level.
44.5, and 39.4 hl/ha. The average yield of controls was 38.7 hl/ha which was significantly lower than the 28.1 and 65.5 l formulations. Benomyl and thiabendazole gave average yields of 43.6 and 44.7 hl/ha, respectively, which were also significantly better than yields of the control.

There were no significant differences in yields when benomyl, chlorothalonil, maneb, thiabendazole and fentin hydroxide were applied to Dare and Ransom soybeans in separate locations in 1975 and compared to a control and to each other (Table 14). Yields of Bragg and Dare soybeans used in 1976 to compare treatments of benomyl, chlorothalonil, fentin hydroxide, thiabendazole, a double rate of benomyl, and combinations of benomyl with chlorothalonil, fentin hydroxide, and thiabendazole were significantly higher than yields of the controls in only two treatments. Yields of the fentin hydroxide alone and benomyl-fentin hydroxide combination treatments on Bragg were significantly greater than Bragg control plot yields (Table 14). The combination treatments had higher yields than did the corresponding treatments of individual fungicides. These yield differences were not significant, however. Also in 1976, benomyl, chlorothalonil, fentin hydroxide and control plots were compared for yield on Dare and Davis varieties in separate experiments. The yield of plots treated with fentin hydroxide was significantly higher than both the control and plots treated with chlorothalonil in Davis and significantly higher than the yield of Dare control plots.
TABLE 14. Yield\textsuperscript{a} in hl/ha of soybeans at four locations in Louisiana treated\textsuperscript{b} with fungicides\textsuperscript{c} applied by hand sprayer which provided 2.81 kg/cm\textsuperscript{2} constant pressure with CO\textsubscript{2} and delivered 160.0 l/ha of formulation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dare Cheneyville</th>
<th>Ransom Erwinville</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benomyl</td>
<td>46.7</td>
<td>37.0</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>37.5</td>
<td>37.1</td>
</tr>
<tr>
<td>Fentin hydroxide</td>
<td>45.1</td>
<td>37.2</td>
</tr>
<tr>
<td>Maneb</td>
<td>41.9</td>
<td>36.9</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>40.5</td>
<td>35.1</td>
</tr>
<tr>
<td>Control</td>
<td>40.5</td>
<td>37.8</td>
</tr>
<tr>
<td>LSD 5%=6.27</td>
<td></td>
<td>LSD 5%=2.99</td>
</tr>
<tr>
<td>LSD 1%=7.86</td>
<td></td>
<td>1%=4.07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dare Cheneyville</th>
<th>Bragg Krotz Springs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benomyl</td>
<td>41.2</td>
<td>46.7</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>31.6</td>
<td>43.2</td>
</tr>
<tr>
<td>Fentin hydroxide</td>
<td>35.4</td>
<td>49.9*</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>35.1</td>
<td>41.8</td>
</tr>
<tr>
<td>Benomyl (double rate)</td>
<td>37.4</td>
<td>44.4</td>
</tr>
<tr>
<td>Benomyl-Chlorothalonil</td>
<td>33.8</td>
<td>46.3</td>
</tr>
</tbody>
</table>
TABLE 14. (Continued)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dare</td>
<td>Bragg</td>
</tr>
<tr>
<td></td>
<td>Cheneyville</td>
<td>Krotz Springs</td>
</tr>
<tr>
<td>Benomyl-Fentin hydroxide</td>
<td>38.2</td>
<td>49.5*</td>
</tr>
<tr>
<td>Benomyl-Thiabendazole</td>
<td>41.1</td>
<td>42.7</td>
</tr>
<tr>
<td>Control</td>
<td>31.1</td>
<td>43.2</td>
</tr>
<tr>
<td>LSD 5%=11.15</td>
<td></td>
<td>LSD 5%=3.79</td>
</tr>
<tr>
<td>1%=14.56</td>
<td></td>
<td>1%=7.41</td>
</tr>
</tbody>
</table>

*aMean of three replications/treatment except for Ransom-Erwinville which had four replications/treatment.*

*bTwo applications, first at late flowering, early pod set and second 2 weeks later.*

*c1975 application rates: benomyl, fentin hydroxide, maneb - 0.89 kg/ha; chlorothalonil - 0.95 l/ha; thiabendazole - 307.0 ml/ha. 1976 application rates: benomyl - 0.28 kg/ha; chlorothalonil - 0.95 l/ha; fentin hydroxide - 0.54 kg/ha; thiabendazole 184.2 ml/ha.*

*Denotes significance at 5% level.*
Variety test. Mean yields of benomyl-treated plots of varieties Mack, Dare, Forrest, Curtis, Pickett 71, and Bragg were significantly higher than those of untreated plots of the same varieties. Mean yields of treated plots were higher than those of untreated plots in all varieties. These data are found in Table 15.

In vitro fungicide experiment. Benomyl and captafol completely inhibited growth of both C. dematium var. truncata and D. phaseolorum var. sojae at the 500 ppm concentration. Thiabendazole and fentin hydroxide also completely inhibited D. phaseolorum var. sojae growth at 500 ppm.

Colletotrichum dematium var. truncata growth was completely inhibited by captafol at 50 ppm. Chlorothalonil inhibited the growth of both fungi the least. Fentin hydroxide and thiabendazole inhibited C. dematium var. truncata growth less than benomyl and captafol but more than chlorothalonil. The growth of D. phaseolorum var. sojae appeared to be nearly equally inhibited by benomyl, thiabendazole, fentin hydroxide, and captafol. These data are in Table 17.

Greenhouse fungicide experiment. There were no significant differences in seed weight, number of pods, or number of seeds between any treatments in either Dare or Davis varieties (Table 16). There was no delay in maturity of any of the treatments. None of the plants in any of the treatments had signs of either pod and stem blight or anthracnose either on stems or pods. The seed were not discolored (Fig. 5). Seed germination was 100% and the germinated seed showed no signs of
TABLE 15. Mean yields of soybean varieties treated with 0.56 kg/ha of benomyl at the Dean Lee Agriculture Center, 1976.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield (hl/ha)</th>
<th>Increase Over Control (hl/ha)</th>
<th>LSD 5%=</th>
<th>1%=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill</td>
<td>42.5</td>
<td>3.0</td>
<td>LSD 5%=4.61</td>
<td>1%=6.79</td>
</tr>
<tr>
<td>Hill Control</td>
<td>39.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mack</td>
<td>48.1**</td>
<td>4.7</td>
<td>LSD 5%=1.22</td>
<td>1%=1.83</td>
</tr>
<tr>
<td>Mack Control</td>
<td>43.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dare</td>
<td>50.7*</td>
<td>4.8</td>
<td>LSD 5%=4.44</td>
<td>1%=6.53</td>
</tr>
<tr>
<td>Dare Control</td>
<td>45.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forrest</td>
<td>49.2*</td>
<td>6.7</td>
<td>LSD 5%=5.74</td>
<td>1%=8.44</td>
</tr>
<tr>
<td>Forrest Control</td>
<td>42.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Davis</td>
<td>51.7*</td>
<td>4.0</td>
<td>LSD 5%=3.39</td>
<td>1%=5.05</td>
</tr>
<tr>
<td>Davis Control</td>
<td>47.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracy</td>
<td>40.2</td>
<td>1.2</td>
<td>LSD 5%=2.09</td>
<td>1%=3.05</td>
</tr>
<tr>
<td>Tracy Control</td>
<td>48.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curtis</td>
<td>43.0*</td>
<td>1.4</td>
<td>LSD 5%=1.39</td>
<td>1%=2.00</td>
</tr>
<tr>
<td>Curtis Control</td>
<td>41.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickett 71</td>
<td>49.5*</td>
<td>2.3</td>
<td>LSD 5%=2.26</td>
<td>1%=2.78</td>
</tr>
<tr>
<td>Pickett 71 Control</td>
<td>47.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee 74</td>
<td>49.6</td>
<td>1.8</td>
<td>LSD 5%=2.52</td>
<td>1%=3.74</td>
</tr>
<tr>
<td>Lee 74 Control</td>
<td>47.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bossier</td>
<td>50.5</td>
<td>2.5</td>
<td>LSD 5%=3.57</td>
<td>1%=5.22</td>
</tr>
<tr>
<td>Bossier Control</td>
<td>48.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bragg</td>
<td>53.9*</td>
<td>3.8</td>
<td>LSD 5%=3.48</td>
<td>1%=5.22</td>
</tr>
<tr>
<td>Bragg Control</td>
<td>50.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ransom</td>
<td>53.9</td>
<td>2.2</td>
<td>LSD 5%=3.65</td>
<td>1%=5.39</td>
</tr>
<tr>
<td>Ransom Control</td>
<td>51.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Denotes significance at 1% level.

*Denotes significance at 5% level.
TABLE 16. Average culture diameter (cm) and percent inhibition of growth of *Colletotrichum dematium* var. *truncata*, isolate 7616, and *Diaporthe phaseolorum* var. *sojae*, isolate 7617, growing on potato dextrose agar containing fungicides at different concentrations (ppm-volume).

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>C. dematium var. truncata, isolate 7616</td>
<td></td>
</tr>
<tr>
<td>Benomyl</td>
<td>2.95</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>5.95</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>6.53</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
<tr>
<td>Fentin hydroxide</td>
<td>3.53</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
<tr>
<td>Captafol</td>
<td>6.13</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
</tbody>
</table>

D. phaseolorum var. sojae, isolate 7617

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Benomyl</td>
<td>3.40</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>3.88</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>4.22</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
</tr>
</tbody>
</table>
TABLE 16. (Continued)

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>0</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D. phaseolorum var. sojae, isolate 7617</strong> (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentin hydroxide</td>
<td>3.19</td>
<td>2.26</td>
<td>1.85</td>
<td>1.63</td>
<td>1.24</td>
<td>0.77</td>
<td>0.51</td>
<td>0</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
<td>29</td>
<td>42</td>
<td>49</td>
<td>61</td>
<td>76</td>
<td>84</td>
<td>100</td>
</tr>
<tr>
<td>Captafol</td>
<td>4.05</td>
<td>2.84</td>
<td>1.94</td>
<td>1.34</td>
<td>0.85</td>
<td>0.65</td>
<td>0.45</td>
<td>0</td>
</tr>
<tr>
<td>% inhibition</td>
<td>0</td>
<td>30</td>
<td>52</td>
<td>67</td>
<td>79</td>
<td>84</td>
<td>89</td>
<td>100</td>
</tr>
</tbody>
</table>
TABLE 17. Means of four replications of total seed weight (g), number of pods, and number of seed of Dare and Davis soybeans grown in the greenhouse and sprayed with fungicide, Baton Rouge, Louisiana, 1976.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Seed Weight</th>
<th>Number of Pods</th>
<th>Number of Seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAVIS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benomyl</td>
<td>81.2</td>
<td>250.00</td>
<td>409.00</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>85.8</td>
<td>243.00</td>
<td>403.75</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>87.5</td>
<td>240.25</td>
<td>404.75</td>
</tr>
<tr>
<td>Fentin hydroxide</td>
<td>81.4</td>
<td>233.25</td>
<td>396.00</td>
</tr>
<tr>
<td>Untreated</td>
<td>82.9</td>
<td>246.75</td>
<td>405.00</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>10.95</td>
<td>17.08</td>
<td>19.40</td>
</tr>
<tr>
<td>LSD 1%</td>
<td>14.99</td>
<td>23.37</td>
<td>27.74</td>
</tr>
<tr>
<td><strong>DARE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benomyl</td>
<td>81.7</td>
<td>258.25</td>
<td>432.75</td>
</tr>
<tr>
<td>Thiabendazole</td>
<td>82.2</td>
<td>261.50</td>
<td>433.25</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>84.9</td>
<td>261.50</td>
<td>434.50</td>
</tr>
<tr>
<td>Fentin hydroxide</td>
<td>83.2</td>
<td>260.50</td>
<td>437.50</td>
</tr>
<tr>
<td>Untreated</td>
<td>86.1</td>
<td>263.75</td>
<td>445.50</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>9.97</td>
<td>29.89</td>
<td>15.09</td>
</tr>
<tr>
<td>LSD 1%</td>
<td>13.64</td>
<td>40.90</td>
<td>20.65</td>
</tr>
</tbody>
</table>
Fig. 5. Seed and pods of Dare soybeans grown in an apparently disease-free environment. A. Seeds showing no discoloration. B. Pods showing no signs of fungal infection.
fungal infection.

**Germination tests.** Seeds of fungicide-treated plants usually had a slightly higher germination percentage than did those from untreated plants. These data are shown in Table 18 and were not statistically analyzed. The percent germination varied highly among experiment locations.

**Percent infection determinations.** The percent infection by *Diaporthe* spp. on seed from Lee 74 and Davis plants treated with benomyl at Lake Charles and Crowley, respectively, was significantly lower than the percentage of infected seeds from untreated plants. At LSU-A all varieties examined had fewer *Diaporthe*-infected seed from benomyl-treated plots than from untreated plots. The percentage from Mack and Bragg were significantly less. The amount of *Diaporthe* spp. infection in seeds from Davis plants at Tallulah treated with benomyl, chlorothalonil, and fentin hydroxide did not differ significantly from seed from untreated plants. Infection data are shown in Table 19.

**Disease ratings.** The ratings for all treatments of the Dare and Curtis fungus inoculation experiments differed little in 1975. The benomyl treatments had the lowest rating in both varieties. Anthracnose was usually very severe in all treatments of both Curtis and Dare wherever it was found. Anthracnose prevalence was greater in the upper one-third of the plant, whereas pod and stem blight was equally prevalent throughout the pods and stems. The 1975 disease ratings are in Tables 20 and 21.
TABLE 18. Percent germination of soybean seed from plants treated with foliar fungicide and from untreated plants in Louisiana, 1976.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Location</th>
<th>Treatment</th>
<th>% Germination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis</td>
<td>Crowley</td>
<td>Benomyl</td>
<td>66.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benomylb</td>
<td>65.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>65.75</td>
</tr>
<tr>
<td>Lee 74</td>
<td>Lake Charles</td>
<td>Benomyl</td>
<td>91.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benomylb</td>
<td>93.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>91.00</td>
</tr>
<tr>
<td>Mack</td>
<td>LSU-A</td>
<td>Benomyl</td>
<td>91.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>84.75</td>
</tr>
<tr>
<td>Forrest</td>
<td>LSU-A</td>
<td>Benomyl</td>
<td>95.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>91.75</td>
</tr>
<tr>
<td>Davis</td>
<td>LSU-A</td>
<td>Benomyl</td>
<td>86.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>83.50</td>
</tr>
<tr>
<td>Bragg</td>
<td>LSU-A</td>
<td>Benomyl</td>
<td>97.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>97.00</td>
</tr>
<tr>
<td>Davis</td>
<td>Tallulah</td>
<td>Benomyl</td>
<td>68.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chlorothalonil</td>
<td>75.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fentin hydroxide</td>
<td>66.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>68.00</td>
</tr>
<tr>
<td>Bragg</td>
<td>Batchelor</td>
<td>Benomyl</td>
<td>96.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chlorothalonil</td>
<td>97.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thiaabendazole</td>
<td>96.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>93.25</td>
</tr>
</tbody>
</table>

*Applied in 46.8 l/ha water unless otherwise stated.*

*Applied in 28.1 l/ha water.*

*Mean of four replications of 100 seed each.*
TABLE 19. Percent of seed found to be infected with *Diaporthe* spp. from soybean plants sprayed with foliar fungicides and from untreated plants.

<table>
<thead>
<tr>
<th>Location</th>
<th>Variety</th>
<th>Treatmenta</th>
<th>% Infectionc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Charles</td>
<td>Lee 74</td>
<td>Benomylb</td>
<td>4.00**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benomyl</td>
<td>5.25**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>13.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=3.28 1%=4.63</td>
</tr>
<tr>
<td>Crowley</td>
<td>Davis</td>
<td>Benomyl</td>
<td>3.50**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benomyl</td>
<td>5.75*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>14.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=7.44 1%=10.50</td>
</tr>
<tr>
<td>LSU-A</td>
<td>Mack</td>
<td>Benomyl</td>
<td>13.50*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>29.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=14.47 1%=21.41</td>
</tr>
<tr>
<td>LSU-A</td>
<td>Forrest</td>
<td>Benomyl</td>
<td>5.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>9.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=6.17 1%=9.13</td>
</tr>
<tr>
<td>LSU-A</td>
<td>Davis</td>
<td>Benomyl</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>9.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=7.38 1%=10.92</td>
</tr>
<tr>
<td>LSU-A</td>
<td>Bragg</td>
<td>Benomyl</td>
<td>2.25**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>7.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=3.17 1%=4.69</td>
</tr>
<tr>
<td>Tallulah</td>
<td>Davis</td>
<td>Benomyl</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chlorothalonil</td>
<td>5.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fentin hydroxide</td>
<td>5.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSD</td>
<td>5%=2.81 1%=3.89</td>
</tr>
</tbody>
</table>

aApplied in 46.8 l/ha water unless stated otherwise.

bApplied in 28.1 l/ha water.

cMean of four replications of 100 seed each.

**Denotes significance at 1% level.

*Denotes significance at 5% level.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Replication</th>
<th>Pod and Stem Blight Pods</th>
<th>Stem Blight Pods</th>
<th>Anthracnose Pods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Severity^a</td>
<td>Prevalence^b</td>
<td>Severity</td>
</tr>
<tr>
<td>Control</td>
<td>I</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Combination</td>
<td>I</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Combination + Anthracnose</td>
<td>I</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Anthracnose</td>
<td>I</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Benomyl</td>
<td>I</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

^a Severity: 1 = very mild, 2 = mild, 3 = moderate, 4 = severe
^b Prevalence: 1 = none, 2 = less than 5%, 3 = 5-25%, 4 = 25-50%, 5 = 50-75%, 6 = 75-100%
| TABLE 20. (Continued) |

<table>
<thead>
<tr>
<th>a0</th>
<th>None, 1. very light, 2. light-moderate, 3. severe, 4. very severe or entire.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>None, 1. 1-25%, 2. 26-50%, 3. 51-75%, 4. Over 75% of pods or stem infected.</td>
</tr>
</tbody>
</table>
TABLE 21. Disease ratings from Dare plants inoculated with fungi, Burden Research Farm, Baton Rouge, Louisiana, 1975.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Replication</th>
<th>Pod and Stem Blight</th>
<th>Anthracnose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pods</td>
<td>Stems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severity</td>
<td>Prevalence</td>
</tr>
<tr>
<td>Control</td>
<td>I</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Combination</td>
<td>I</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Combination + Anthracnose</td>
<td>I</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Anthracnose</td>
<td>I</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Benomyl</td>
<td>I</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
TABLE 21. (Continued)

a. None, 1. very light, 2. light-moderate, 3. severe, 4. very severe or entire.

b. None, 1. 1-25%, 2. 26-50%, 3. 51-75%, 4. over 75% of pods or stems infected.
Disease ratings for Curtis and Bragg fungus inoculation experiments in 1976 showed small differences except that benomyl-treated plots had lower ratings in both varieties. In Curtis, the rating of plots inoculated with the combination + anthracnose was slightly higher than the rest. These ratings are shown in Table 22.
TABLE 22. Petiole disease ratings from Curtis and Bragg varieties in the R-7 stage, Burden Research Farm, Baton Rouge, Louisiana, 1976.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Treatment</th>
<th>Replication</th>
<th>Total Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Curtis</td>
<td>Control</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Combination</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Combination + Anthracnose</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Anthracnose</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Benomyl</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Benomyl + Combination</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Bragg</td>
<td>Control</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Combination</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Combination + Anthracnose</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Anthracnose</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Benomyl</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Benomyl + Combination</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>
DISCUSSION

Results of fungus inoculation experiments reaffirm that benomyl induces yield increases in soybeans. There is no clear indication, however, of the effects of artificial inoculation with *Colletotrichum dematium* var. *truncata* alone or in combination with *Cercospora sojina*, *Corynespora cassicola*, and *Diaporthe phaseolorum* var. *sojae* on yields. Soybeans have been grown intensively in recent years in experimental plots at the Burden Research Center. Although soybean plant debris is plowed under soon after harvest each year, there has probably been an increase of soil-borne disease inoculum, especially anthracnose and pod and stem blight. This could be a factor which masks the effects of artificial inoculations on experimental plots. Natural inoculum of *C. sojina* was apparently present in high quantities in 1975 and rainfall was such that optimum conditions for disease development were persistent throughout much of the growing season. Lack of severe infection by *C. sojina* in 1976 could account for the lack of a yield response in Curtis relative to 1975. Lehman (8) reported that soybean anthracnose is more severe in periods of high rainfall, thereby causing production of greater quantities of inoculum. Rainfall was greater during the growing season in 1975 than in 1976 (96.7 cm - 67.1 cm). This could partially account for the greater yield increases induced by benomyl in the fungus inoculation experiments in 1975.
The timing sequence of two applications, the first at LFEPS and the second 2 weeks later, has generally been accepted and recommended (6) for foliar fungicides of soybeans. Results of timing-sequence studies add validity to this acceptance. The highest and most consistent yield increases were from plots treated with two applications as outlined above. The results indicate that two applications applied within the EF to LFEPS stages of pod development induce higher and more consistent yield increases than earlier or later timing sequences. Tiffany (12) reported that mycelial development of anthracnose in previously infected plants is very slow until about the time flowering starts. Logically, it would appear that this period may be when the plant requires the most protection against yield losses induced by pod and stem inhabiting fungi. Benomyl and thiabendazole used in timing experiments are systemic fungicides whereas chlorothalonil and fentin hydroxide are not. It remains to be seen if the systemic nature of either benomyl or thiabendazole has an effect on the development of the C. *dematium* var. *truncata* or D. *phaseolorum* var. *sojae* mycelia within the plant. It is not known what part, if any, secondary infection by C. *dematium* var. *truncata* or D. *phaseolorum* var. *sojae* plays in yield losses. Appressoria and penetration pegs are formed by C. *dematium* var. *truncata* (12), whereas D. *phaseolorum* is a wound parasite (10).

Fungicide screening tests results show that a broad range of fungicides are able to induce yield increases in soybeans under the conditions of a particular experiment. Inconsistencies at various
locations may arise from different levels of disease pressure, weather conditions, and the variety itself.

The increases in yield induced by combinations of two fungicides may be due to control of a greater spectrum of fungi with the combination than with either of the combinants or simply the additive effect of more fungicide being applied in a treatment. Further work with combinations of fungicides used at rates lower than when they are used singly is needed.

Variation in environmental conditions such as wind velocity and temperature at the time of application of fungicides by airplane influences the amount of coverage. The higher the temperature and the greater the wind velocity, the more chance of water evaporation during the flight of the spray. The tests with 28.1 vs. 46.8 l of water/ha to carry benomyl indicated that the greater volume of liquid is necessary when applications are made under less than ideal conditions.

Differences in varietal response to fungicides could be due to the nature of the varieties. Varietal growth characters, resistance to disease, and maturity groups probably have an effect on response to diseases. Although not all the varieties tested showed a significant yield increase in response to benomyl, two of those which did not, Lee 74 and Tracy, showed significant yield increases in response to benomyl in outfield experiments reported herein. Dortchsoy also responded with significantly increased yields when treated with benomyl in an outfield experiment. These experiments need to be repeated for more complete comparisons of varietal response to benomyl.
and possibly other fungicides as they attain Environmental Protection Agency labels.

The greenhouse experiment was designed to show the effects of fungicides on plants in a relatively disease-free environment, i.e. without disease pressure. As stated earlier, there was no observed response to the fungicides in this experiment. Benomyl has shown growth-regulating properties in muskmelon (16) and some workers believe chlorothanil has growth-regulating properties in soybeans (personal communication). Neither of these responses was observed in the greenhouse. The delayed maturity found in field soybeans did not take place in the greenhouse. If the extra growing period allows seeds on treated plants to increase in size and weight it would be because reduced disease pressure allows a normal maturation.

Benomyl, chlorothalonil, fentin hydroxide, thiabendazole and captafol inhibited in vitro growth of C. dematium var. truncata and D. phaseolorum var. sojae. The relative amounts of control among pathogens varied considerably. Percent inhibition in vitro was not correlated with yield increases on sprayed soybeans in the field. All the in vitro studies indicated fungistatic control only.

Several factors pointed to antifungal activity by foliar fungicides. These factors include: 1. lower incidence of Diaporthe spp. on seeds from treated plants, 2. lower disease rating on fungicide-treated plants, 3. yield increases by a wide range of fungicides, 4. yield increases by nine varieties to fungicide treatment, 5. lack of response (increase yields, number of pods or seeds) to fungicide
treatment of varieties grown in a relatively disease-free environment, and 6. growth inhibition of C. dematium var. truncata and D. phaseolorum var. sojae in vitro.

This report substantiates earlier claims of significant yield increases of soybean varieties when sprayed with foliar applications of fungicides. Although no tests were made to determine the effects of fungicides as growth regulators, the possibility of these materials acting as growth regulating agents cannot be discarded. The greenhouse test which dealt with foliar fungicides applied as in the field is additional evidence that disease control is the major factor involved in causing yield increases.
LITERATURE CITED


VITA

Thomas Morton Fort, III was born November 24, 1946, the son of Cherrie Perkins Fort and Thomas Morton Fort, Jr. He graduated in June, 1964 from Stewart County High School in his hometown of Lumpkin, Georgia. In September, 1964 he entered North Georgia College, Dahlonega, and received a Bachelor of Science degree in biology in June, 1968.

He entered the United States Army in August, 1968 where he served as an officer until August, 1970.

In November, 1968 he married Bobbie Thorne and now has one son, Jeff.

He entered the University of Georgia, Athens, in September, 1970 and received a Master of Science degree in plant pathology in August, 1974.

He enrolled in Louisiana State University in August, 1974 and is currently a candidate for the Doctor of Philosophy degree in plant pathology.
Candidate: Thomas Morton Fort, III

Major Field: Plant Pathology

Title of Thesis: The Control of Anthracnose and Pod and Stem Blight of Soybean by Application of Foliar Fungicides

Approved:

[Signature]
Major Professor and Chairman

[Signature]
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signature]

[Signature]

[Signature]

[Signature]

Date of Examination:

November 29, 1976