Plant diseases - Downy mildew of onions

R. F. Doepel
DOWNY MILDWDE OF ONIONS
Report on Fungicidal Spray Experiment
By R. F. DOEPEL, Plant Pathologist, and M. HARDIE,
Vegetable Instructor.

DOWNY mildew of onions caused by the fungus Peronospora destructor is widespread in Western Australia. In market gardens adjacent to Perth where the majority of onions are grown the disease occurs each year in spring and early summer crops and often attains epidemic proportions. Onion mildew kills the leaves and so retards bulb development and as a result yields are often seriously lowered.

Spraying for the control of this disease has seldom been attempted in this State, but last season the control value of a number of spray materials was tested in a field experiment in the Spearwood district. One of the newer fungicides, zineb, gave an approximate 20 per cent increase in yield of marketable onions.

SYMPTOMS AND EFFECTS

Downy mildew first becomes noticeable on the basal or older leaves. These turn greenish-yellow, hang down limply and gradually wither back from the tips (Fig. 1). The disease spreads to the younger leaves which are killed progressively as they develop. The fungus may be seen on affected leaves as a grey-violet furry covering (Fig. 2) which is most evident in the early morning after rain or heavy dew.

Seedstalks may also be attacked by mildew and bend or break at the site of infection. As a result seed formation is prevented or if the seed matures it is often shrivelled.
DISEASE DEVELOPMENT

The fungus grows in the leaf tissues and produces spores which are blown about by wind or splashed by water. These spores give rise to new leaf infections and so spread the disease rapidly through the crop and to neighbouring crops.

The fungus may progress inside the leaves down into the bulb; such bulbs if retained for seed purposes can carry the disease.

Resting spores, known as oospores, are also produced in the leaf tissues and can survive in diseased leaves in the soil to infect healthy plants the following season.

Mildew development is favoured by cool moist weather conditions; frequent dews encouraging prolific spore production by the fungus.

HOST RANGE

All varieties of onions are attacked as also are shallots, leeks and garlic.

TESTING OF SPRAYS

Variable control of mildew with fungicidal sprays has been reported by overseas workers. In this State, the main fungicide used has been a lime sulphur—resin soap spray, each ingredient being used at 1 per cent. concentration.

Last year an experiment was conducted on a field crop of onions in the Spearwood district to test several recently available organic fungicides and the lime sulphur—resin soap spray for mildew control.

Preliminary tests on onion foliage with all the fungicides used showed that with the exception of lime sulphur—resin soap the materials as formulated did not wet the leaves adequately. However, wetting and coverage of the waxy foliage was greatly improved when either Agral LN or Triton B 1956 proprietary spreaders were added to these fungicides. For this reason these spreaders were tested with each material excepting the lime sulphur—resin soap spray.

Experimental Design and Treatment

For the experiment, six beds of onions (4 rows of plants per bed) were selected from a very uniform stand in a late October field planting. Plots were two beds in width and 12 links in length and contained about 250 plants. The experiment was of random block design with three replications of each treatment. All sprays were applied with a knapsack spray (Fig. 3). Unsprayed buffer plants were left between treatment plots to encourage mildew development.
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ADELAIDE.
Spray strengths of the various fungicides used are listed in the table below:

**TABLE 1.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Strength of Spray</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 Gallons Water</td>
</tr>
<tr>
<td>Copper oxychloride</td>
<td>3¼ lb.</td>
</tr>
<tr>
<td>Thiram</td>
<td>1½ lb.</td>
</tr>
<tr>
<td>Ziram</td>
<td>1½ lb.</td>
</tr>
<tr>
<td>Zineb</td>
<td>1½ lb.</td>
</tr>
<tr>
<td>TZU-4311*</td>
<td>1½ lb.</td>
</tr>
<tr>
<td>Captan</td>
<td>2 lb.</td>
</tr>
<tr>
<td>Lime sulphur—resin soap</td>
<td>1% of each.</td>
</tr>
</tbody>
</table>

* TZU-4311 is an experimental fungicide having the composition 40 per cent. thiram, 20 per cent. ziram, 20 per cent. tetramethyl-dithiocarbamine-acid-methylarsine and remainder inert material.

The Agral LN and Triton B1956 spreaders were used with each of the materials listed above, excepting the lime sulphur—resin soap mixture at the rate of 6 fluid ounces in 100 gallons of spray.

Five spray applications were made to the plots at approximately ten day intervals, commencing on November 11, three weeks after the onions had been planted out from the seedbed.

**Disease Development.**

Although no detailed assessments were made mildew developed throughout all experimental plots but was not as severe as in adjacent earlier planted crops on the same property.

**Plot Records.**

All plots were harvested at maturity on January 19, and after curing for a fortnight (Fig. 4) the onions were topped, graded and weighed.

The following table gives the total yields in lb. for the various treatments:

**TABLE 2.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yields of Cured Onions (Average of 3 Plots.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control—unsprayed</td>
<td>51.3</td>
</tr>
<tr>
<td>2. Copper oxychloride + Agral</td>
<td>50.7</td>
</tr>
<tr>
<td>3. Copper oxychloride + Triton</td>
<td>53</td>
</tr>
<tr>
<td>4. Thiram + Agral</td>
<td>44</td>
</tr>
<tr>
<td>5. Thiram + Triton</td>
<td>48</td>
</tr>
<tr>
<td>6. Ziram + Agral</td>
<td>52</td>
</tr>
<tr>
<td>7. Ziram + Triton</td>
<td>57.3</td>
</tr>
<tr>
<td>8. Zineb + Agral</td>
<td>62.3</td>
</tr>
<tr>
<td>9. Zineb + Triton</td>
<td>65</td>
</tr>
<tr>
<td>10. TZU-4311 + Agral</td>
<td>45</td>
</tr>
<tr>
<td>11. TZU-4311 + Triton</td>
<td>55.3</td>
</tr>
<tr>
<td>12. Captan + Agral</td>
<td>53.3</td>
</tr>
<tr>
<td>13. Captan + Triton</td>
<td>49.3</td>
</tr>
<tr>
<td>14. Lime sulphur—Resin soap</td>
<td>50.7</td>
</tr>
<tr>
<td>Least significant difference 5% level</td>
<td>8.7</td>
</tr>
<tr>
<td>Least significant difference 1% level</td>
<td>11.8</td>
</tr>
</tbody>
</table>
Discussion.

Of all the sprays tested, zineb was the only fungicide which gave significantly higher yields of onions than the control. Both the Agral LN and Triton B1956 spreaders proved satisfactory with each spray in giving good coverage of the leaves.

The disease developed very rapidly in the experimental plots during the early stages of crop growth. At this time the zineb sprayed plants had noticeably less blighting of the foliage due to mildew attack than plants in any other treatment and were also more vigorous. Subsequently further disease development was checked by unsuitable weather conditions and at harvest time the differences observed earlier were much less noticeable. However, the yield increases obtained in plots sprayed with zineb were considered due, in part at least, to mildew control.

As the disease this season was not as serious as normally experienced it is planned to conduct further tests next season using earlier planted crops grown when conditions are generally more favourable for mildew development.

RECOMMENDATIONS

As control of mildew is very difficult to achieve once the disease has become established in a crop, prevention must be aimed at rather than cure.

The following measures are therefore recommended for the control of this disease:

1. Sanitation.
   As the fungus can persist from season to season in crop remains, all dead leaves and discarded bulbs should be burnt after harvesting has been completed.

2. Rotation.
   To prevent infection of seedlings and field crops from diseased refuse in the soil, a rotation should be adopted so that onions are not grown on the same land more frequently than once every three years.

   From the results obtained in this season’s experiment, it is tentatively recom-
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