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ROOT DISEASES IN WHEAT ON CLOVER LEY
-Factors Under Investigation

5. THE EVALUATION OF FUNGICIDAL TREATMENTS

By S. C. CHAMBERS, M.Sc., Plant Pathologist

The use of fungicides, either as seed or soil dressings, for the control of root rotting diseases of wheat, was examined in a series of field experiments. Results suggest that seed dressings have no effect on the incidence of root rotting fungi in the mature crop. When fungicides were applied to the soil, a reduction in the incidence of take-all was noted in one experiment, but the same treatments had toxic effects on plants in a second similar experiment.

ROOT rots of wheat are most serious in the southern clover ley districts of Western Australia, particularly in years when seedling growth is retarded by adverse seasonal conditions.

These diseases are caused by several soil borne fungi which can attack the crop at any stage of growth. Recent surveys suggest that Ophiobolus graminis (the cause of take-all) and Fusarium spp. are the main fungi associated with root rotting in these clover ley areas.

Although control of these diseases is difficult, there is evidence that root rots can be considerably reduced by adopting practices, such as rotations, which reduce the amount of soil borne inoculum.

The use of fungicides for the control of root diseases has received little attention in most countries, mainly because rotations have offered a more practical solution. Furthermore, it is generally accepted that fungicides either applied to the soil or used as seed dressings are unlikely to give worthwhile control. However, because of the lack of supporting evidence, Cass Smith (1961) initiated field trials in 1954 with fungicides mixed and drilled with the standard fertiliser.

Results from these experiments were inconclusive, mainly because of the low incidence of root rots in the area. Consequently, further trials have been undertaken at sites where root rotting is more prevalent and have been designed to evaluate fungicides both as soil and seed dressings.

EXPERIMENTAL

Clover ley land was used at Avondale Research Station, Beverley and Esperance Downs Research Station for four multifactorial experiments which included the use of fungicides.
The individual plots were 500 links long and 12 rows wide. The times of seed bed preparation and seeding varied according to local seasonal conditions.

The incidence of root diseases was evaluated in these experiments during October, 1960, by the method described previously (Chambers 1962).

Toxic effects on the plants were observed at Beverley after the application of fungicides to the soil (Table 2), but there was no evidence of this in any of the other experiments.

Analyses of results are contained in Tables 1-3.

### Application of Fungicides

1. **Fungicides Applied as Seed Dressings**

Three fungicides—copper carbonate, organic mercury and Thiram—were used as seed dressings at the rate of 2 oz. per bushel.

At Beverley, six replications of these seed treatments were included in the trial, which was cultivated initially on June 22, 1960, and seeded one week later.

The trial at Esperance contained eight replications of the seed treatments. The plots were first cultivated on June 21, and were sown on June 28, 1960.

2. **Fungicides Applied to the Soil**

Three materials—calcium cyanamide, pentachloronitro-benzene (PCNB) and Thiram—were mixed with the superphosphate fertiliser and applied to the soil during seeding, at the rate of 20 lb. per acre.

The trial at Avondale Research Station, containing 12 replications of these treatments, was first cultivated on June 3, 1960 and seeded on June 10, 1960. Emergence was assessed three weeks after sowing and was based on the numbers of seedlings per metre of row, taking 15 randomised samples from each plot.

A second experiment at Esperance was smaller, having only six replications of the treatments. Here the plots were ploughed on June 8, 1960, and sown eight days later.

### Results

The commonest fungi associated with root rotting in these experiments were *Ophiobolus graminis* (Esperance) and *Fusarium avenaceum* (Beverley and Esperance). A number of other pathogenic fungi were detected but only in trace amounts.
TABLE 3
Incidence of Common Root Pathogens and Yield of Wheat in Relation to the Use of Soil Fungicides at Esperance Downs Research Station

<table>
<thead>
<tr>
<th>Soil fungicide (20 lb./acre)</th>
<th>Mean No. of Stools/40 ft. of row affected by</th>
<th>Yield (bush./acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fusarium avenaceum</td>
<td>Ophiobolus graminis</td>
</tr>
<tr>
<td>Calcium cyanamide</td>
<td>38-0</td>
<td>40-2</td>
</tr>
<tr>
<td>PCNB</td>
<td>27-2</td>
<td>18-5</td>
</tr>
<tr>
<td>Thiram</td>
<td>41-3</td>
<td>26-2</td>
</tr>
<tr>
<td>Control</td>
<td>48-0</td>
<td>45-2</td>
</tr>
<tr>
<td>Differences</td>
<td>not significant*</td>
<td>see below†</td>
</tr>
</tbody>
</table>

* Using transformation $X^4$.  
† (i) Calcium cyanamide and control not significantly different.  
(ii) PCNB and thiram significantly less than control (at $P = 0.05$ level).

**DISCUSSION**

None of the seed treatments had any effect upon the incidence of root pathogens in the mature crop or on yield (Table 1). This is probably due to the fact that a seed dressing would only afford a limited zone of protection to the plant in the early seedling stage.

When fungicides were applied to the soil at Esperance Downs, the incidence of take-all was reduced in some instances, but there was no corresponding increase in yield (Table 3). Furthermore, at Avondale these same treatments appear to have had phytotoxic effects upon the crop. This is indicated by the reduced seedling emergence following all soil treatments and also by the decrease in yield where calcium cyanamide and PCNB had been applied to the soil. These phytotoxic effects have made it impossible to accurately assess the effect of soil fungicides on root diseases at Avondale Research Station.

In view of the results from these four experiments, it may be concluded that none of the treatments under test have any practical value for the control of root diseases in wheat crops.

**ACKNOWLEDGMENTS**

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**REFERENCES**
