IDENTIFICATION OF DISEASE SUPPRESSIVE SOILS IN WESTERN AUSTRALIA

M.S. Miyan, D. Hüberli and W. MacLeod
Department of Agriculture and Food Western Australia, South Perth, WA. Email: shahajahan.miyan@agric.wa.gov.au

ABSTRACT. Survey of cereal root disease was conducted in the early 1980s and in 2006-2008 in Western Australia (WA). Results of these surveys show that there has not been a reduction in the incidence or severity of root diseases during the past 25 years. The greatest levels of all root diseases in WA remained in the southern high rainfall zone. This study was carried out to identify sites which are suppressive for one or more wheat root diseases. Cereal roots were collected from this region and assessed for Rhizoctonia solani (AG8), Fusarium pseudograminearum (fusarium crown rot), Gaeumannomyces graminis var. tritici (take-all) and Pratylenchus neglectus root lesion nematodes; RLN) at anthesis in 2010 and 2011. We identified fourteen paddocks for rhizoctonia, six for take-all, seventeen for crown rot and one for RLN as potentially suppressive in both years. The eleven paddocks identified as suppressive for rhizoctonia in 2010 were bioassayed along with a positive control from Esperance, WA, previously identified to be suppressive. Only the positive control was recorded to be highly suppressive with disease incidence being significantly reduced when 0.5g of carbon was added.

INTRODUCTION
Results of two root disease cereal surveys in Western Australia (WA) in the early 1980s and from 2006 to 2008 show that there has not been a reduction in the incidence or severity of root diseases during the past 25 years. The recent survey showed that the highest levels of all root diseases such as fusarium crown rot, rhizoctonia root rot, take-all, and RLN are in the southern high rainfall zone of WA which has a large potential increase in grain production. Biological suppression could be a valuable tool to control these root diseases and increase crop production in this region.

Disease suppression in our study is defined as the ability of soil to suppress the incidence or severity of disease, even in the presence of the pathogen, a host plant and a favourable environment. Improved information on disease suppression of cereal root diseases will enable grain growers to reduce their potential losses.

The main objectives of this work is to identify and confirm sites suppressive to one or more wheat root disease/s and determine the components of suppressive sites using traditional methods including determination of nematode community groups as a measure of soil biological activity.

MATERIALS AND METHODS
Survey Cereal roots (mostly wheat) were assessed for disease incidence and severity of rhizoctonia, take-all, crown rot and RLN from about 236 paddocks in 2010 and in 2011 to identify sites with putatively suppressive soil. A total of 40 to 100 plants per paddock were assessed at anthesis. Putative disease suppressive paddocks were identified by comparing the root disease incidence with the pre-sowing soil pathogen inoculum determined by the PreDicta-B test; suppressive sites were those that had high to medium inoculum levels with no, or very little, incidence of disease.

Rhizoctonia bioassay Small pots with 300 g soil per site were amended with 0, 0.5g, 1.0g of sugar and inoculated with 0, 2 and 4 millet seed inoculum and placed in a growth cabinet for two weeks at 10°C with a 12 h light/dark regime (1). Pots were sown with five wheat seeds/pot after two weeks incubation. Seedlings were harvested four weeks later and roots assessed for rhizoctonia incidence which was recorded as proportion of roots affected per plant (1).

RESULTS AND DISCUSSION
Survey There were eleven paddocks for rhizoctonia, six for take-all, twelve for crown rot and one for RLN potentially suppressive to disease in 2010 (Table 1). In 2011, five additional sites for crown rot and three additional sites for rhizoctonia were identified but no additional suppressive paddocks were identified for take-all and RLN (Table 1).

Table 1. Cereal paddocks identified as suppressive in 2010 and 2011 based on disease incidence and PreDicta-B tests.

<table>
<thead>
<tr>
<th>Disease</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take-all</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Crown Rot</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Rhizoctonia root rot</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Root lesion nematodes</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>8</td>
</tr>
</tbody>
</table>

Bioassay The eleven paddocks identified as suppressive to R. solani in 2010 were bioassayed along with a positive control from Esperance, WA, previously identified to be suppressive by G. Vadakattu (pers. comm.). Only the positive control was recorded to be highly suppressive with disease incidence being significantly reduced when 0.5g of sugar was added. Five paddocks showed moderate suppression with disease severity only reduced in the 1g sugar amendment. Three of the remaining sites were low in suppressiveness, while two sites, identified as potentially suppressive in the survey were non-suppressive, suggesting that microbial activity involved in suppression is probably low for all five of these sites (Figure 1).

Figure 1. Rhizoctonia disease incidence level (%) in a wheat seedling bioassay of potentially suppressive paddock soils. Vertical bars are least significant difference (LSD). EDRS is the positive control.

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REFERENCES

7th Australasian Soilborne Diseases Symposium