AN ON-FARM PREDICTIVE SYSTEM FOR CROWN ROT OF WHEAT

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INTRODUCTION
Crown rot, caused by *Fusarium pseudograminearum*, remains one of the major constraints on cereal production in reduced tillage systems. The pathogen is residue-borne and disease incidence depends on the quantity of infested residues carried over from previous crops. Management strategies include rotation, use of tolerant varieties, and precision sowing. However, decisions about disease management must be made before sowing.

This paper describes development of a predictive system that allows crops to be placed into risk categories for incidence of crown rot. It also discusses factors that influence the relationship between incidence and yield loss, and how these affect decisions based on risk.

MATERIALS AND METHODS
Standard epidemiological analyses were conducted on crown rot epidemics in long-term trials (1). Environmental and agronomic parameters that could be determined prior to sowing with minimum equipment or training were explored for their ability to predict incidence in the coming season. Only data for bread wheats were used.

RESULTS AND DISCUSSION
Epidemiological analyses showed that the dominant influence on crown rot incidence was the quantity of infested residue. For on-farm use, this could be estimated from yield, and the incidence of symptoms (stem browning) at maturity. The relationship took the form

\[
\text{Incidence} = a\sqrt{\text{previous incidence} \times \text{previous yield}}
\]

The value of the constant \(a\) differed between trials, but using \(a = 5\) gave a good fit between predicted and measured incidence over a range of sites, varieties and years in northern NSW and southern Qld (Fig. 1).

![Figure 1. Actual and predicted incidence of crown rot based on a simple relationship between previous incidence and yield for 23 wheat crops.](image)

Predicted incidence is of most use if it can place a crop into a risk category which triggers specific management decisions. Suggested categories are low risk, in which losses will be small relative to other factors affecting yield under most conditions; high risk, in which economically significant risk is certain under most conditions; and medium risk, in which losses could be high under adverse conditions but acceptable under good conditions or with appropriate management. The boundaries between risk categories (Table 1) have also been chosen based on what can be achieved in practice. For example, wheat-sorghum rotations, considered to give good control of crown rot, result in equilibrium incidences of 10-15\% (2).

To simplify calculations, an index based on the product of previous incidence and yield can be used to place crops into risk categories (Table 1).

<table>
<thead>
<tr>
<th>Risk</th>
<th>Incidence</th>
<th>Index</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;10-15%</td>
<td>&lt;10</td>
<td>0-1</td>
</tr>
<tr>
<td>Medium</td>
<td>10-30%</td>
<td>10-40</td>
<td>2</td>
</tr>
<tr>
<td>High</td>
<td>&gt;25-30%</td>
<td>&gt;40</td>
<td>3+</td>
</tr>
</tbody>
</table>

An alternative method of placing crops into risk categories is to use a history score, developed from analysis of the rate of increase in incidence between seasons and the rate of breakdown of residue. The number of susceptible crops in the last 5 years is counted, and then the number of years since the last susceptible crop is subtracted (Table 1). This is less reliable than the incidence \(x\) yield index, because it does not take into account the decrease in risk following drought years or increase in risk following heavy crops.

The risk thresholds suggested here apply only to bread wheat. While incidence of crown rot in barley and durum wheat can also be estimated by similar methods, thresholds for economic damage are higher for barley and lower for durum.

Actual loss in any season will depend on severity of disease as well as incidence. Severity is affected by several factors including rainfall, temperature, and N nutrition. In practice these are most important for crops in the medium risk category. Growers must make their own assessment of climatic risk in the coming season. If wheat is to be grown under medium risk, the crop should be managed to minimise stress.

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REFERENCES