Tan spot management in wheat crops

Background
Tan spot (*Pyrenophora tritici-repentis*), known in Australia as yellow leaf spot, is an important disease of wheat in many parts of the world. Cereals most at risk are wheat and triticale, though barley and rye can be affected with limited infection. Oats are resistant.

Where is the disease likely to be found first?
Tan spot is a stubble borne disease, so wheat following wheat is at most risk of early infection. However later in the season all wheat crops can be infected as a result of wind-blown secondary spores (conidia).

In the 2012/13 season the principal regions where the disease was observed were South Canterbury, Fairlie Basin and the Hakataramea Valley. There were one or two reports from Mid Canterbury.

In 2013/14 it has already been identified outside of these areas with reports from Southland and Central Canterbury.

Key points
- Tan spot (*Pyrenophora tritici-repentis*) is an important disease of wheat in many parts of the world.
- In the 2012/13 season tan spot was observed in South Canterbury, the Fairlie Basin and the Hakataramea Valley. We have already received reports this season of the disease showing up outside of these regions, in Southland and Central Canterbury.
- Tan spot is a stubble borne disease, so wheat following wheat is at highest risk of early infection. However later in the season all wheat crops can be infected as a result of wind-blown secondary spores (conidia).
- Selection of cultivars with more resistance will help, but resistance is unlikely to be complete.
- Reducing inoculum by burying or burning stubble are the most effective prevention measures.
- Fungicides are unable to provide any real curative activity, however overseas data suggests that programmes focussing on the flag and ear sprays are the most effective at preventing disease build up on the top two leaves.
- A broad spectrum combination of triazole and strobilurin applied at robust rates on the flag leaf and again on the ear is a good option for second or continuous wheat crops.
- Growers outside the higher risk areas may not need to change fungicide strategy to take account of this disease unless it is observed in crops prior to flag leaf.
How does the disease spread?
Tan spot is stubble borne. Initial infection comes from the stubble of the previous wheat crop, and as these spores only travel a few centimetres, it is usually second and continuous wheat crops that are most at risk. Under humid conditions spores are released from black fruiting bodies on the straw. These fruiting bodies can mature over a wide window of time (overseas studies), which results in wide windows of potential infection.

In Australia, where crops are often direct drilled into stubble, wheat following canola (oilseed rape) can still become infected from spores in the wheat stubble left over from the crop sown prior to the canola, despite a break of over 12 months. In addition, work from Western Australia has indicated that infection intensity in the following wheat is related to how susceptible the previous wheat cultivar was to the disease.

Once infection is established in the growing crop and under wet conditions (6-18 hours of leaf wetness) the lesions resulting from the stubble borne spores can give rise to a secondary level of infection based on wind-blown spores (conidia). These spores travel further and can give rise to infection in first wheat crops after the break.

Cultural control of this disease
Selection of cultivars with more resistance (see assessment of FAR CPT trial below) will help, but resistance is unlikely to be complete.

The main cultural control technique, particularly for second and continuous wheat, is to remove as much stubble from the surface as possible so as to reduce inoculum potential. Burying stubble with cultivation and or burning it are the most effective measures.

Stubble from all wheat cultivars can carry inoculum, but Australian research has found that susceptible cultivars carry more fruiting bodies than resistant ones (Figure 1). In disease conducive conditions where the fruiting bodies on the straw are mature, inoculum arising from any wheat stubble can result in significant disease.

Figure 1. Influence of stubble age and cultivar resistance on tan spot fruiting body production (Correll and Yitpi (S-VS susceptible-very susceptible), Wyalkatchem (MR-moderately resistant) – courtesy of Jeff Thomas, DAFWA.

Varietal resistance
As cultivars differ in different production zones there is little overseas tan spot data that New Zealand can rely on. Therefore the only data we currently have is from assessments conducted by FAR staff in the Fairlie Basin in January 2013. The results of the assessment are shown in Table 1, but it must be emphasised that this data is limited to one site, so is at best provisional. Note that none of the cultivars showed good genetic resistance that could be described as truly resistant to this disease.
**Table 1.** Provisional tan spot cultivar ratings (assessed during late milk grain fill GS77) – Fairlie Basin CPT cultivar trial 2012/13 N.B. Ratings taken after fungicide programme applied.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Provisional Rating*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claire</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>Einstein</td>
<td>Susceptible (S)</td>
</tr>
<tr>
<td>Empress</td>
<td>Moderately resistant-moderately susceptible (MR-MS)</td>
</tr>
<tr>
<td>Excede</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>Orator</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>Phoenix</td>
<td>Moderately resistant-moderately susceptible (MR-MS)</td>
</tr>
<tr>
<td>Richmond</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>Savannah</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>Wakanui</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>CMWW06</td>
<td>Moderately resistant-moderately susceptible (MR-MS)</td>
</tr>
<tr>
<td>CRWT168</td>
<td>Moderately resistant-moderately susceptible (MR-MS)</td>
</tr>
<tr>
<td>KWW42</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>KWW45</td>
<td>Moderately susceptible (MS)</td>
</tr>
<tr>
<td>KWW46</td>
<td>Moderately resistant-moderately susceptible (MR-MS)</td>
</tr>
<tr>
<td>KWW47</td>
<td>Moderately resistant-moderately susceptible (MR-MS)</td>
</tr>
<tr>
<td>NFC10739</td>
<td>Susceptible (S)</td>
</tr>
</tbody>
</table>

* Caution limited data

**Foliar fungicide control**

**i) Products**

Fungicides can be very effective in controlling biotrophic diseases (diseases requiring living host e.g. rusts), but unfortunately, they are less effective against the necrotrophic disease tan spot, particularly if the grower is depending on curative activity. Tan spot’s very short, five to seven day, latent phase (time between spore landing on the leaf and infection being evident) means there is little curative activity available in the fungicide armoury to combat this disease. However the more effective products can give useful protection against this disease if they are used as part of a targeted programme. New Zealand data for control of this disease is scarce and until more data is generated this season we need to look overseas.

Research in Denmark and Australia over the last three seasons would suggest that of the triazoles, propiconazole (e.g. Tilt®), still remains effective against this disease, and that of the newer products, prothioconazole (Proline®), is effective. In Australia, prothioconazole has been mixed with tebuconazole (e.g. Folicur®) as the product Prosaro®, which has also produced good results. However, in side by side comparisons in Australia, straight tebuconazole has not been as effective as propiconazole. Of the strobilurins, pyraclostrobin has been rated highly in testing, but should be mixed with a good triazole to get the best results.

The problem with propiconazole (eg Tilt) is that it is less effective on other diseases that may be present such as Septoria and rusts. Don’t rule out mixtures of different triazoles in order to provide a broader spectrum of activity.

**ii) Management strategies**

In Australia, infection in second wheat crops occurs over winter, and infection can be severe in the tillering phase. Controlling tan spot at this timing under Australian conditions has produced few positive results (in terms of economics) since disease infection from the stubble continues over a long period of time, giving rise to infection in new leaves which haven’t been protected with fungicide. In addition, in many cases, drier weather during stem elongation controls the disease naturally as the disease is dependent on wet weather. Where yield loss from the disease has occurred in Australia, it is when infection moves up the crop canopy and infects the top two leaves of the crop.

Unlike Australia, where winter temperatures are higher, New Zealand’s 2012/13 season infection came late. Low levels of infection were noted in early November (in the Fairlie Basin and Hakataramea Valley), then increased dramatically at the start of the new year. This infection pattern is more similar to Denmark where infection builds up very quickly late in the season (Figures 2a and 2b).
Figure 2a. Infection build up (disease progress) from ear emergence on the top three leaves of an untreated crop. (Courtesy of Lise Jorgensen, Aarhus University, Denmark).

Figure 2b. Disease progress comparing untreated versus a propiconazole programme. (Courtesy of Lise Jorgensen, Aarhus University, Denmark).
Tan spot management may require the development of two different fungicide strategies. One for second or continuous wheat crops and the other for first wheat crops where the disease may be more significant later in the season.

Second and continuous wheat

Where a cultivar is considered moderately susceptible or poorer, your fungicide choice should be based on a broad spectrum combination of triazole and strobilurin, and ideally both partners should be applied at robust rates on the flag leaf and again on the ear. Remember the fungicide combination also needs to be effective on any other diseases present. This latter point is particularly important where one might consider an older azole such as Tilt to partner a strobilurin. Do not rule out mixing two triazoles together. An older product such as Tilt with a newer triazole such as Opus®.

Consider triazoles mixed with a strobilurin such as Comet® applied at flag and again at ear emergence. Rates, particularly at ear emergence, are likely to depend on the levels of take-all evident at ear emergence and whether the crop is dryland or irrigated. Higher rates should be considered for irrigated crops or where there are no obvious signs of early senescence due to take-all.

First wheat

In first wheat crops the fungicide programme is less influenced by tan spot threat, as first wheats tend to have more robust ear emergence fungicide applications, though it might be advisable to check product choice to see if it covers tan spot as well as the others diseases targeted if you are growing in a region where tan spot was prominent last year.

For growers outside the higher risk areas, there may be no need to change fungicide strategy to take account of this disease unless it is observed in crops during stem elongation.
Future Research
In addition to in-field fungicide trials being conducted this season, FAR are assisting with funding for a Masters study being conducted at Lincoln University examining four objectives:
Objective 1: Determine the incidence and severity of tan spot caused by Pyrenophora tritici-repentis (Ptr) in wheat cropping areas.
Objective 2: Determine the race structure and genetic diversity of the New Zealand Ptr population.
Objective 3: Determine susceptibility of commonly grown wheat cultivars.
Objective 4: Determine sensitivity to different fungicides (in vitro lab assessment).

We need your help – please forward reports of this disease
Please could all growers and advisers forward observations of tan spot to the FAR office so that we can keep track of regional spread and outbreaks in crops.

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