Wheat case study

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Partners
disease problems in wheat
What was the objective of the wheat case study?

- How are diseases in winter wheat managed in different countries?
- Collect information on strategies and measures to control diseases in winter wheat
- Exchange the best practises, which support disease control strategies based on IPM
• Output:
  – Report and brochures
  – Guides for advisors and farmers (From Science to Field)
  – Input to Endure Information Centre
  – Start of www.EuroWheat.org
# Wheat case study

## Pesticide use on winter wheat in 4 countries

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbicides</td>
<td>2.43</td>
<td>1.5</td>
<td>1.9</td>
<td>1.71</td>
</tr>
<tr>
<td>Fungicides</td>
<td>2.26</td>
<td>1.6</td>
<td>1.9</td>
<td>0.56</td>
</tr>
<tr>
<td>Insecticides</td>
<td>1.08</td>
<td>0.3</td>
<td>1.2</td>
<td>0.15</td>
</tr>
<tr>
<td>PGRs</td>
<td>0.97</td>
<td>0.7</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>6.74</td>
<td>4.1</td>
<td>5.8</td>
<td>2.62</td>
</tr>
<tr>
<td>Yield (ton/ha)</td>
<td>8.0</td>
<td>6.9</td>
<td>7.3</td>
<td>7.3</td>
</tr>
</tbody>
</table>

## Fungicide use versus disease pressure/yield response
Variety resistance
Key element in diseases practice – addressing IPM
Wheat case study

Significance of cultivar resistance
With respect to yield losses

Source: 108 trials in France
Cultivar resistance and fungicide requirement

Resistant cultivar

Susceptible cultivar


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Fusarium is a good case where IPM is needed!

Typical life cycle of *Fusarium* species in wheat.

DON risk assessment grid on wheat ARVALIS-Institut du végétal 2008

<table>
<thead>
<tr>
<th>Previous crop</th>
<th>Tillage</th>
<th>Varietal susceptibility</th>
<th>Risk category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals, oilseed rape, flax, peas, beans, sunflowers</td>
<td>Ploughing</td>
<td>Low susceptibility</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium susceptibility</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td></td>
</tr>
<tr>
<td>Cereals, oilseed rape, flax, peas, beans, sunflowers</td>
<td>No ploughing</td>
<td>Low susceptibility</td>
<td>2a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium susceptibility</td>
<td>2a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td>2a</td>
</tr>
<tr>
<td>Sugar beet, potatoes, soya, others</td>
<td>Ploughing</td>
<td>Low susceptibility</td>
<td>2b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium susceptibility</td>
<td>2b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td></td>
</tr>
<tr>
<td>Sugar beet, potatoes, soya, others</td>
<td>No ploughing</td>
<td>Low susceptibility</td>
<td>2a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium susceptibility</td>
<td>2a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td></td>
</tr>
<tr>
<td>Grain maize, sorghum (forage maize)</td>
<td>Ploughing</td>
<td>Low susceptibility</td>
<td>(2a)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium susceptibility</td>
<td>(2b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td>(3)</td>
</tr>
<tr>
<td>Grain maize, sorghum (forage maize)</td>
<td>No ploughing</td>
<td>Low susceptibility</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium susceptibility</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td>(5)</td>
</tr>
</tbody>
</table>

Figure 4: Decision key for DON risk (Source: Arvalis, France)
Information is worth very little if not updated!
www.EuroWheat.org
disease management with focus IPM
Information on non-chemical control measures for control of wheat diseases

Wheat case study

Cultural practices impact on disease development

Non-chemical control of wheat diseases
Select 1 to change information in the right hand info box
1 Eyespot
1 Yellow rust
1 Brown rust
1 Powdery mildew
1 Septoria leaf blotch
1 Tan spot
1 Fusarium head blight
1 Take-all

In relation to minimizing disease risk the following elements are known to be of major importance:

- Diversification of crop rotations.
- Use of resistant cultivars and/or variety mixture.
- Removal of debris.
- Reduced use of nitrogen.
- Optimal sowing conditions and timing.

Important links

AHDB/HGCA: The Encyclopaedia of Cereal Diseases
Wheat Disease Encyclopaedia To find references indicated in the hard brackets, please select the Help Icon in upper right corner.

Fusarium head blight

Fusarium spp AHDB/HGCA photos

Resistance genes Varieties with good resistance are known, and may help to reduce disease levels. Several non-specific genes are used and described e.g. Fh1 from Chinese spring wheat. Different types of resistance are described: Resistance to initial infection (type I), resistance to pathogen (type II), ability to degrade mycotoxins (type III and IV), or resistance to grain infection (type V). Tall cultivars are often seen to be less susceptible (longer distance for inoculum to spread). Compact heads are known to increase the risk of attack. Open flowering increase the risk of infection.

[1,7,8,22,32,36,41]

Previous crop Maize as previous crop has been found to increase the risk of fusarium head blight. Wheat has also been found to potentially increase the risk in some regions. [14,36]

Sowing date Not found to be of specific importance

Tillage Ploughing decreases the risk by removing inoculum. Minimal tillage significantly increases the risk when wheat follows maize or wheat. [3,31]

Debris and volunteers Crop debris on the surface increases the risk of disease development. [3,27,36,39,42]

Nitrogen level No information available

Nitrogen strategy No information available

Crop density No information available

Landscape No information available

Soil type No information available
# Wheat case study

## Information on control thresholds for wheat diseases in different countries

### Control thresholds for wheat leaf diseases used in different countries

<table>
<thead>
<tr>
<th>Monitoring for diseases in wheat</th>
<th>Yellow rust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select to change information in the right hand info box</td>
<td><img src="image" alt="Puccinia striiformis AHDB/HGCA photos" /></td>
</tr>
<tr>
<td>Eyespot</td>
<td><strong>Yellow rust</strong></td>
</tr>
<tr>
<td>Yellow rust</td>
<td></td>
</tr>
<tr>
<td>Brown rust</td>
<td></td>
</tr>
<tr>
<td>Powdery mildew</td>
<td></td>
</tr>
<tr>
<td>Septoria leaf blotch</td>
<td></td>
</tr>
<tr>
<td>Tan spot</td>
<td></td>
</tr>
</tbody>
</table>

### General principles for disease development

Following infection, the fungus develops for some time in the plant before symptoms appear. Latent period varies between the different diseases from 4-5 days to 3 weeks. Symptoms on lower leaves are generally less important compared with symptoms appearing on yield-forming upper leaves. Most control strategies aim at keeping the 3 upper leaves free from diseases.

Disease development is very complex and the severity of diseases in a season depends on the amount of disease inoculum, weather and the variety’s genetic ability to ‘resist’ that pressure. A higher fungicide dose is needed when disease pressure is high and varietal resistance is low. Conversely, a resistant variety facing low disease pressure may not require any treatment.

Unfortunately disease forecasting is not a very precise discipline. Therefore risk assessment is often reduced to estimating, if risk of disease development is nil, low, moderate or high. Threshold is however still believed to be of good value, when the risk has to be decided.

### General principles used for assessing diseases

When a field is assessed, it is important either to take out plant samples which are representative of the field (often around 100) or to make a visual assessment in the crop at 10-20 localities in the field depending on the size, in order to get a full picture of the disease level. Walk across the field (use the tramlines) and make sure to cover both high risk and low risk areas of the field. The crop ideally has to be assessed every 3-4 days to detect the early symptoms of disease.

### NVB guidelines

- **>1 % plants with attack. GS 29-60 (S). >10 % plants attacked after GS 61-71 (S)**
- **>1 % plants with attack or foci (S) GS 29-59. >10 % plants with attack (R)**
- **At first symptoms.**
- **1-2 % severity or foci present.**
- **From GS 31: at first symptoms. Before GS 31: if spots are present and they are active.**
- **First foci present.**
- **At GS 30-31: 25-30 % tillers with lesions**
- **First symptom occurrence on the upper 2 leaves.**

Crops must be inspected carefully for small patches of infection (foci) before, and during, stem extension. Look out for the disease on all green parts between GS 29 and 60 and once the disease is seen in the crop, it is recommended to spray. The most recently emerged leaves always appear disease free between foci, as the disease is not able to travel over long distances. It is therefore very important to control the disease at this stage.
Conclusion

• Good process
• Good outputs
• Added value to national information
• Still much to do!
• Hope to get the chance to continue the networking!?
• Continue development of EuroWheat