Elicitor screening to protect winter wheat against *Zymoseptoria tritici*

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Develop a method based on **Eliciting agents** to **protect wheat** against *Zymoseptoria tritici*.
Wheat Pathogen: *Zymoseptoria tritici*

- Hemibiotrophic fungi *Mycosphaerella graminicola*
- **Septoria Tritic**i Blotch (STB) foliar disease
- **40% yield loss** in wheat crops

**FOLIAR SYMPTOMS**
(after 21-28 days after infection)

Elongated, tan lesions containing characteristic black fruiting structures (asexual pycnidia)

Rainfall favors spores to splash onto upper leaves and heads

No wheat cultivar fully resistant to *Z. tritici*

Disease control relies mainly ON FUNGICIDES
ELICITOR = all signals perceived by plants and inducing a defensive reaction

CONCEPT OF INDUCED RESISTANCE

- For a wide variety of plants
- Against a broad-spectrum of diseases (bacteria, virus, fungi)

Very few elicitors have been identified for wheat
Leaf perception

- Burst of Reactive oxygen species
- Ion fluxes
- Synthesis of Phytoalexins, PR-proteins

Root perception

Defense induction

Signaling
SCREENING METHODOLOGY
ELICITOR SCREENING METHODOLOGY

1. Preventive treatment with 9 different « elicitor » molecules
2. Inoculation with *Zymoseptoria tritici* (1.10^6 spores.ml^-1)
3. Measurement of Disease Severity

Wheat at 3-4 leaf stage

5 day gap

28th day post-inoculation (dpi)
### PREVENTIVE TREATMENT WITH 9 DIFFERENT « ELICITORS »

<table>
<thead>
<tr>
<th>EGL1</th>
<th>EGL2</th>
<th>EGL3</th>
<th>EGL4</th>
<th>EGL5</th>
<th>EGL6</th>
<th>EGL7</th>
<th>EGL8</th>
<th>EGL9</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 (mg/ml)</td>
<td>0.1</td>
<td>0.001</td>
<td>9.5 \times 10^{-5}</td>
<td>0.3</td>
<td>0.006</td>
<td>0.006</td>
<td>0.12</td>
<td>Dil.x2000</td>
</tr>
<tr>
<td>C2 (mg/ml)</td>
<td>1</td>
<td>0.01</td>
<td>9.5 \times 10^{-4}</td>
<td>3</td>
<td>0.06</td>
<td>0.06</td>
<td>1.2</td>
<td>Dil.x200</td>
</tr>
<tr>
<td>C3 (mg/ml)</td>
<td>5</td>
<td>0.1</td>
<td>0.0095</td>
<td>30</td>
<td>0.625</td>
<td>0.625</td>
<td>12</td>
<td>Dil.20</td>
</tr>
</tbody>
</table>

Control 1: water  
Control 2: water + adjuvants  
Control 3: BION®, Syngenta Europe (0.6mg/ml)
SCREENING RESULTS
Molecules EGL 1, 2, 3 and 4 contributed to reduce Zymoseptoria tritici symptoms by at least 40%

For each molecule, all concentrations were efficient

Adjuvants added to treatment did not have an impact on disease infection
Results for EGL5-EGL6-EGL7

Bars tagged with the same letter are not significantly different using the Tukey test at $P=0.05$

- **EGL 5, 6 and 7** contributed to reduce *Zymoseptoria tritici* symptoms at various concentrations

Control showed 12.3% of leaf surface with symptomatic lesions
# RESULTS for EGL7-EGL8-EGL9

<table>
<thead>
<tr>
<th>Doses (mg/ml)</th>
<th>EGL7</th>
<th>EGL8</th>
<th>EGL9</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.12</td>
<td>Dil.x2000</td>
<td>0.002</td>
</tr>
<tr>
<td>C2</td>
<td>1.2</td>
<td>Dil.x200</td>
<td>0.008</td>
</tr>
<tr>
<td>C3</td>
<td>12</td>
<td>Dil.x20</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Control showed 15.5% of leaf surface with symptomatic lesions

- **EGL 7** showed once more an impact, but just at concentration C2 (1.2mg/ml)

Bars tagged with the same letter are not significantly different using the Tukey test at $P=0.05$
BIOCIDE ACTIVITY (*in vitro*)
Dose-response curve of *Zymoseptoria tritici* growth on PDA medium with different elicitor concentrations.

EGL5:

- * at 0.89
- *** at 1.36
- ** at 1.84
- * at 2.32
- ** at 2.80

EGL6:

- * at 0.89
- *** at 1.36
- ** at 1.84
- * at 2.32
- ** at 2.80

EGL7:

- ** at 2.17
- ** at 2.65
- ** at 3.12
- ** at 3.60
- ** at 4.08

Ongoing experiment with the other EGLs.

Control: ......
CONCLUSIONS

- Several molecules contributed to reduce STB foliar infection on wheat (algae extracts, peptide, alcaloïde and oligosaccharide).

- In the three screening tests, disease pressure on control was low (12% to 15% of leaf surface covered with symptomatic lesions). Yet, statistical analysis showed that several molecules were efficient.
  
  Testing these molecules further, under field conditions, is therefore interesting and legitimate according to C.Maumené (Arvalis Institut du Végétal, France).

- Biocide tests *in vitro* and *in planta* are also carried out to ensure the observation of an « elicitor effect »

**NEXT STEP**

Choosing the 2 best elicitor molecules
Study plant enzymatic activity and defense gene expression
Field trials
THANK YOU FOR YOUR ATTENTION!