Efficacy of Prestop® against soil borne and foliar pathogens on European crops
Core business: Production of micro-organisms

- Biers
- Bakker's yeast and products
- Animal Care (health/nutrition)
- Human Care (health/nutrition)
- Distilled alcools and ethanol
- Plant Care (health/nutrition)
- Bio-ingredients
- Wine

- Wine
Biological plant protection products and biofertilizer for agriculture, horticulture and forestry
Biological plant protection products for horticulture

Prestop

based on *Gliocladium catenulatum*
strain 1446
Current Registrations of Prestop

US and European approval (EPA and Annex 1)
Ecological characteristics of strain J1446

- Isolated from Finnish field soil within a Nordic project on biocontrol of seed-borne pathogens of cereals 1989-93

- Biological activities: between 6 and 30°C

- Able to survive below 6°C and above 30°C

- Not harmful to beneficial insects, nematodes or pollinators

*Gliocladium catenulatum*

J1446
Ecological characteristics of strain J1446

*Gliocladium catenulatum* J1446 is able to colonize leaf and root surface

*G. catenulatum* growing on water agar, isolated from cucumber roots.

*G. catenulatum* growing on potato dextrose agar, isolated from pelargonium leaves.
Various modes of action are involved:

- Hyperparasitism seems to play an important role:
  - Detection of enzyme activities
  - Observation of mycelium interaction

- Competition for nutrients and space
  - Colonization of root and foliar surfaces

- Antibiosis not shown

Weak probability of development of pathogen resistance
The compatibility between *Gliocladium catenulatum* and chemical pesticides

*In vitro*

- **Teldor**
  (fenhexamid)
- **Switch 62.5 WG**
  (cyprodinil and fludioxonil)
The compatibility between *Gliocladium catenulatum* and chemical pesticides

*In vivo*

Full compatibility with Topsin M (tiophanate-methyl) on *cucumber* when sprayed at the same day
<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Examples of commercial name</th>
<th>Interval (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoxystrobin</td>
<td>Amistar</td>
<td>2</td>
</tr>
<tr>
<td>Benomyl</td>
<td>Benlate</td>
<td>4</td>
</tr>
<tr>
<td>Boscalid et kréoxim-méthyl</td>
<td>Collis</td>
<td>0</td>
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<tr>
<td>Bitertanol</td>
<td>Baycor</td>
<td>2</td>
</tr>
<tr>
<td>Carboxin</td>
<td>Cadan, Oxalin, Vitavax</td>
<td>4</td>
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<tr>
<td>Fenhexamide</td>
<td>Teldor</td>
<td>0</td>
</tr>
<tr>
<td>Fludioxonil-cyprodinil</td>
<td>Switch</td>
<td>4</td>
</tr>
<tr>
<td>Guazatine</td>
<td>Panoctine</td>
<td>2</td>
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<tr>
<td>Hymexazol</td>
<td></td>
<td>7</td>
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<tr>
<td>Imazalil</td>
<td>Fungaflor</td>
<td>2</td>
</tr>
<tr>
<td>Iprodione</td>
<td>Chipco Green 75WG / Rovral</td>
<td>4</td>
</tr>
<tr>
<td>Krézoxym-méthyl</td>
<td>Stroby, Candit</td>
<td>0</td>
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<tr>
<td>Mancozeb</td>
<td>Dithane, Mancozeb</td>
<td>4</td>
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<tr>
<td>Mépanipyrim</td>
<td>Frupica</td>
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<tr>
<td>Métalaxyli-M</td>
<td></td>
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<tr>
<td>Myclobutanil</td>
<td>Systhane 24 EC</td>
<td>0</td>
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<tr>
<td>Penconazole</td>
<td>Topenco, Topas 100 EC</td>
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<tr>
<td>Phosétyl-aluminium</td>
<td>Aliette</td>
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<tr>
<td>Prochloraz</td>
<td>Sportak 45 HF</td>
<td>7</td>
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<td>Procymidone</td>
<td>Fortress 500</td>
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<tr>
<td>Propamocarp Hydrochloride</td>
<td>Previcur® Energy, Previcur N®</td>
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<tr>
<td>Propiconazole + prochloraz</td>
<td>Basso</td>
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<tr>
<td>Pyraclostrobin+boscalid</td>
<td>Signum</td>
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<tr>
<td>Pyriméthanil</td>
<td>Scala</td>
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<tr>
<td>Sulfur</td>
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<td>0*</td>
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<tr>
<td>Thiophanate méthyl</td>
<td>Topsin M</td>
<td>2</td>
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<tr>
<td>Toclofosmethyl</td>
<td>Rizolex</td>
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<tr>
<td>Thiram</td>
<td>Thirame, TMTC, TMTD</td>
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<tr>
<td>Triadiméfon</td>
<td>Amiral, Baylaton</td>
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<tr>
<td>Triadiménol</td>
<td>Baytan</td>
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<tr>
<td>Triforine</td>
<td>Funginex</td>
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<tr>
<td>Trifloxystrobin +propiconazole</td>
<td>Stratego</td>
<td>4</td>
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<tr>
<td>Triflumizole</td>
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<td>0</td>
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<tr>
<td>Vinclozolin</td>
<td>Ronilan</td>
<td>4</td>
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</table>
## Compatibility between *Gliocladium catenulatum* and insecticides

<table>
<thead>
<tr>
<th>Active ingredients</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus thuringiensis</em></td>
<td>0</td>
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<tr>
<td><em>Beauveria bassiana</em></td>
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<tr>
<td>Buprofezin</td>
<td>0</td>
</tr>
<tr>
<td>Cypermethrin</td>
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<tr>
<td>Deltamethrin</td>
<td>0</td>
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<tr>
<td>Diazinon</td>
<td>0</td>
</tr>
<tr>
<td>Fenbutatin oxide</td>
<td>2</td>
</tr>
<tr>
<td>Malathion</td>
<td>0</td>
</tr>
<tr>
<td>Metharizium anisopliae</td>
<td>0</td>
</tr>
<tr>
<td>Mevinphos</td>
<td>0</td>
</tr>
<tr>
<td>Permethrin</td>
<td>2</td>
</tr>
<tr>
<td>Pirimicarb</td>
<td>0</td>
</tr>
<tr>
<td>Pyrethrins</td>
<td>0</td>
</tr>
</tbody>
</table>
USES in CONVENTIONAL, IPM and ORGANIC CROPS

1. Treatments of substrates against *Pythium*, *Phytophthora*, *Rhizoctonia*, *Fusarium*

2. Treatments of vegetable, ornamental and aromatic plants, against *Pythium*, *Phytophthora*, *Rhizoctonia* et *Fusarium*

3. Treatments against black rot of cucumbers (*Didymella*)

4. Treatments against grey mould caused by *Botrytis* on tomatoes, green pepper, cucumbers, strawberries, and ornamental plants
Biological activity of *Gliocladium catenulatum* strain J1446 with Prestop® formulation

Foliar diseases
Prestop® on tomatoes against *Botrytis cinerea*

- In the Netherlands and Belgium, annual crop losses in spring and autumn (up to 25%)
- Airborne spores always available
- Growth conditions:
  - high moisture (> 87%)
  - weak plant tissues (pruning wounds)
Trial in 2008: Prestop® on tomatoes against *Botrytis* (spraying on stems)

**Protocol:**
- Tomato crop – 25 weeks old
- The rate of Prestop® was 100 g suspension per 1000 plants (20ml per stem) per application
- Three times replicated (wk 42, 44, 46)
- Pruning wounds preventively treated by spraying the stems and then inoculated with *Botrytis* spore suspension
- Treated wound covered during 48 hours
- Lesion development on wound
Trial in 2008: Prestop® on tomatoes against Botrytis (spraying on stems)

Results

Preventive application of Prestop = Total protection like chemical treatment

UR, Wageningen, Nederland, Autumn 2008
Trial in 2011: Prestop® on tomatoes against *Botrytis* (spraying on wounds)

Results
Prestop in the control of gummy stem blight of cucumber (*Didymella/Mycosphaerella*)

Spray of the stems 6 and 53 days after planting

![Bar chart showing infected plants percentage](chart)

- **Untreated**: 23,4%
- **Prestop 100g/1000 plants**: 9,6%

Images of infected cucumber stems also shown.
Trials in 2011 and 2012: Low volume spraying of Prestop® in foliar treatment of tomatoes

- LV-spraying (fine fog) was used in a commercial tomato cultivation in Holland
- The pressure was 6 bars and the solution was pumped through a filter-nozzle combination
- An excellent colonization of Gliocladium in the foliage was observed after LV-spraying:
  - *Gliocladium* index (0-3) in larger leaves: average 2.8
  - *Gliocladium* index (0-3) in smaller leaves: average 2.8
- No observation of *Botrytis* (*in vitro* and in the greenhouse)

Tomato producers, Nederland, 2011 and 2012
Novel applications on grapevine

- Trials in 2010 and 2011 in Austria by Kwisda
  - 2010: test at 5 kg
  - 2011: test at 1 kg and 2 kg with or without copper

1. Untreated Check
2. Switch WG 1 kg/ha  BCD
cyprodil 375 g/kg + fluoxidin 250 g/kg
3. Frupica Opti WG 0.8 kg/ha  BCD
mepanpyrin 500 g/kg
4. PRESTOP 1 kg/ha  BCD
5. PRESTOP 2 kg/ha  BCD
6. PRESTOP + Cu++ 1 kg/ha  BCD
7. PRESTOP 1 kg/ha  ABCD

A ... mid flowering BBCH 65-67
B ... Berries beginning to touch, BBCH 77 (36 and 22 DA-A)
C ... Begin of ripening, BBCH 79- 81 (15 and 33 DA-B)
D ... Softening of berries, BBCH 85 (31 and 8 DA-C)
Water volume: 500 and 1000 L/ha.
Control of grapevine grey mould: 1st site

Trial Location: Styria/AT
Variety: Zweigelt

Kwisda experiment
Control of grapevine grey mould: 2nd site

Kwisda experiment:
Similar results with Zweigelt variety in Lower Austria
Biological activity of *Gliocladium catenulatum* strain J1446 with Prestop® formulation

Root diseases

*Pythium, Phytophthora, Rhizoctonia, Fusarium*
Prestop® in the control of root diseases on sweet pepper, applied via drip irrigation

Trial 15/01

Phytophthora

Phytophthora + Prestop WP
Prestop in the control of damping off (\textit{Pythium} and \textit{Rhizoctonia}), 6 weeks after sowing

Control  Prestop by drenching 10g/m\textsuperscript{2}
Prestop® spraying on *Pelargonium* infected by *Phytophthora*
Methods of applications

• Application methods for root and foliar diseases:
  
  – Spraying of the growing medium
  
  – Incorporation in the liquid solution for hydroponic cultures and drip irrigation
  
  – Spraying with standard equipment at normal and low volume (LV-spraying system)
  
  – Spray the pruning wounds with a small hand-sprayer against Botrytis on tomatoes
Conclusions:
Gliocladium catenulatum strain J1446 as a biocontrol agent

- Strain J1446 controls several root diseases as well as foliar pathogens on vegetable, fruit, ornamental and aromatic plants
- Strain J1446 is compatible with many other plant care products
- Prestop is registered in American and European countries
- Prestop is widely used in greenhouse and more and more in field
- Formulation is adapted to standard and alternative systems of application
Thank you for your attention