Surround® WP
Agricultural Crop Protectant

Surround for Insect Management and Protection against Heat and Light Stress
Kurt Volker, Ph.D.
TKI NovaSource

SURROUND WP is a registered “biopesticide/insecticide” in the USA, Canada, Spain, France, Belgium, and Greece. Additional insect control registrations anticipated for Hungary, Costa Rica, Honduras, Brazil, and Mexico.
Product eligible for use in organic farming in accordance with regulation (EC) no. 834/2007 on organic production

Surround is also listed for use in organic agriculture in:
• USA and Canada by OMRI (Organic Materials Review Institute)
• USA by NOP (National Organic Program administered by the U.S. Department of Agriculture)
• Australia by NASAA (National Association for Sustainable Agriculture, Australia)
SURROUND WP Crop Protectant active ingredient is 95% Calcined Kaolin

<table>
<thead>
<tr>
<th>Active substance:</th>
<th>Kaolin (Aluminium silicate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS No:</td>
<td>1332-58-7</td>
</tr>
<tr>
<td>Molecular formula:</td>
<td>Hydrous kaolin: ( \text{Al}_4\text{Si}<em>4\text{O}</em>{10}(\text{OH})_8 ),  &lt;br&gt;Calcined Kaolin: ( \text{Al}_4\text{Si}<em>4\text{O}</em>{14} )</td>
</tr>
<tr>
<td>Molecular mass:</td>
<td>A single molecule cannot exist, &lt;br&gt;approx. 258 g/mol of hydrous kaolin</td>
</tr>
<tr>
<td>Chemical group:</td>
<td>Clay minerals</td>
</tr>
<tr>
<td>Key Feature:</td>
<td>Highest quality kaolin with minimal impurities is heat treated to form calcined kaolin</td>
</tr>
</tbody>
</table>
What is a “particle film”?

- A microscopic layer of mineral particles.
- Allows water and carbon dioxide to pass through the film.
- SURROUND does not block stomata.
- SURROUND selectively reflects UV and IR but allows much of photosynthetically active radiation (PAR) to be transmitted.
- Whole canopy measurements demonstrated SURROUND applied to apple trees actually increased photosynthesis.
SURROUND does not block stomata, therefore does not interfere with photosynthesis
SURROUND kaolin is extensively processed to improve overall safety and functionality.
Surround® kaolin is extensively processed to improve overall safety and functionality.

Analytical studies were conducted by an independent third party laboratory.
SURROUND kaolin is extensively processed to improve overall safety and functionality.

Analytical studies conducted by an independent third party laboratory.
Electron micrographs of uncalcined (hydrous) and the calcined kaolin.

Hydrous kaolin

Calcined kaolin active ingredient in SURROUND

HEAT TREATMENT
Insects controlled and suppressed by SURROUND

- **Insects controlled equal to conventional insecticides**
  - Pear psylla
  - Glassy-winged Sharpshooter
  - Leafhoppers (Homopterans - cicadellids)
  - Lacanobia fruitworm
  - Fruit flies (Ceratitis, Bactrocera)
  - Armyworm
  - Leafminer
  - Olive moth

- **Insects Suppressed**
  - Thrips
  - Aphids
  - Plum Curculio
  - Japanese Beetle
  - Codling moth

Pears, Brazil citrus, CA vines, Pome fruit, vines, Pome fruit, Citrus, Pome fruit, olive, etc., Pineapple, Melon, Olive, Citrus, vines, tomato, Pome fruit, tomato, Pome fruit, Pome fruit, Pome fruit, walnut.
SURROUND impacts insect behavior

SURROUND deters insect damage by

1. Camouflaging the host
2. Repellency (impeding settling)
3. Deterring oviposition
4. Inhibiting feeding (repellent or ’barrier’)
5. Inducing paralysis or altered behavior
6. May cause acute mortality
7. Impeding grasping (insects fall off)
8. Restricting movement or infestation progression in treated plants

Major Mechanisms
In European orchards, psyllids, particularly, the European pear sucker (*Cacopsylla pyri* L), are the most economically important pest of pears.

- *C. pyri* completes 4-6 generations per year.
- The winter form of *C. pyri* is an adult which undergoes a reproductive diapause.
- Over-wintering females lay eggs from January (SE France) to April (Belgium).

After egg hatching, the nymphs go through five stages (L1 to L5) to form adults (summer form).

*C. pyri* damages pears in several different ways:

- it drinks a large quantity of sap;
- it produces honeydew that serves as a growth medium for black sooty mold fungi that reduces market value of fruit;
- Pear psylla is the vector for Pear Decline, caused by ‘*Candidatus Phytoplasma pyri*’. This disease causes a loss of tree vigor and sometimes tree death.
How does SURROUND work?

SURROUND makes a white protective particle film on the surface of treated vegetation.
- The insect does not recognize the host plant which reduces feeding and egg laying;
- Insects which do land on the protected vegetation find it inhospitable for feeding and/or oviposition.
- Young larvae struggle to feed and move.
SURROUND WP Crop Protectant is currently registered against pear psylla in Belgium, France, Greece and Spain.

<table>
<thead>
<tr>
<th>Country</th>
<th>SURROUND kg/ha min-max</th>
<th>Spray volume min-max</th>
<th>Applications min-max</th>
<th>Application minimum interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>20-30</td>
<td>500-1000</td>
<td>1-7</td>
<td>7 days</td>
</tr>
<tr>
<td>France</td>
<td>25-50</td>
<td>1000</td>
<td>1-7</td>
<td>7 days</td>
</tr>
<tr>
<td>Greece</td>
<td>12.5-50</td>
<td>500-1000</td>
<td>Not stated</td>
<td>Not stated</td>
</tr>
<tr>
<td>Spain</td>
<td>25-50</td>
<td>500-1000</td>
<td>Not stated</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

In all countries application window from BBCH 01 to BBCH 69. Which is dormant to the end of flowering.

SURROUND WP Crop Protectant is registered against the first generation of pear psylla, which results from the eggs of overwintering females.

Spray volume is fairly high but prior to drip to allow formation of a homogeneous white particle film.
Repellency: Pear Psylla avoid settling on SURROUND treated plants

Adult Pear Psylla Choice Test

Number of Adults

Time

Day 0  Day 1  Day 2  Day 3

Untreated
Surround
Oviposition Deterrent: Pear Psylla avoid laying eggs on SURROUND treated plants

Pear Psylla Oviposition Choice Test

Number of Eggs

<table>
<thead>
<tr>
<th>Time</th>
<th>Untreated</th>
<th>Surround</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Day 1</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Day 2</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Day 3</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
## EU Registration Efficacy Trials

### % Control of pear psylla nymphs at pear flowering stage

<table>
<thead>
<tr>
<th>Country Year EPPO Zone</th>
<th>SURROUND kg/ha # appl.</th>
<th>Standard kg ai/ha</th>
<th>SURROUND</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>France 2001 Mediterranean</td>
<td>30 kg 5</td>
<td>Decis 0.0175</td>
<td>100</td>
<td>87</td>
</tr>
<tr>
<td>France 2003 Mediterranean</td>
<td>30 kg 4</td>
<td>Decis + oil 0.0175 + 15.4</td>
<td>92</td>
<td>81</td>
</tr>
<tr>
<td>France 2003 Mediterranean</td>
<td>30 kg 3</td>
<td>UTC</td>
<td>89</td>
<td>--</td>
</tr>
<tr>
<td>France 2004 Mediterranean</td>
<td>30 kg 3</td>
<td>Decis 0.175</td>
<td>93</td>
<td>19*</td>
</tr>
</tbody>
</table>

*Pear psylla resistant to Decis (deltamethrin)*
## EU SURROUND Trials: Average control of Pear Psylla.

<table>
<thead>
<tr>
<th></th>
<th>SURROUND</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average pear psylla control/SURROUND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference (9 trials)</td>
<td>92.7</td>
<td>51.2</td>
</tr>
<tr>
<td>Average pear psylla control/SURROUND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>both EPPO zones (12 trials)</td>
<td>93.4</td>
<td>74</td>
</tr>
<tr>
<td>Average pear psylla control/SURROUND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPPO Mediterranean (7 trials)</td>
<td>91.7</td>
<td>62</td>
</tr>
<tr>
<td>Average pear psylla control/SURROUND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPPO Maritime (5 trials)</td>
<td>95.8</td>
<td>86</td>
</tr>
</tbody>
</table>
SURROUND is used pre-bloom on approximately 40% of pear acres in Washington State.
Sunburn suppression

- **Surround greatly reduces the amount of Uva, Uvb, and Infrared radiation that cause sunburn.**
The Surround treatment was 4°C cooler than the control at the hot spot. (39°C versus 43°C).
SURROUND impact on plant health.

The effect of lessening heat stress and increased photosynthesis on drought stressed olives in Italy.

SURROUND
Treated

Untreated
Surround® General Recommendations

• Always apply good, uniform coating of Surround particle film before insect infestation occurs.
• Utilize adequate application rate: initial 5% followed by 2.5% w/v. (50 kg/ha followed by 20 kg/ha in 1000 l/ha or appropriate spray volume) on a 14 - 28 day schedule.
• Maintain particle film coating during infestation period. This may be season long such as needed for olive moth or only prior to key infestation stages, such as, overwintering adult pear psylla or prior to egg laying stage of some fruit flies.
• Utilize good scouting program to monitor insect population.
• Can anticipate added plant health benefits of Surround treatment: less heat stress, sunburn, better quality, higher yields, general plant vigor improvement.
Thanks
Merci
Grazi
Obrigado
Danke

For more information visit:

www.novasource.com