Canopy Penetration and Deposition of Barrier Sprays from Electrostatic and Conventional Sprayers

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Background

• **Insecticidal barrier treatments**
  To prevent insects from entering or damaging a building

• **Barrier treatments to vegetation**
  potential to prevent insects from moving into an area surrounded by the treated vegetation.

• **Barrier treatments for insect control application**
  localized application to vegetation or natural/man-made surfaces (resting place for mosquitoes)

• **The application technique**
  intended to reduce not to eliminate the adult insect population.
Background

- Expected Benefits
  - timeliness
  - reduced cost
  - reduced pesticide use.

ULV sprays a name in public health spray application
Electrostatic is the talk of the time
Objective

• To evaluate the effectiveness of barrier sprays from electrostatic and conventional sprayers.
• Evaluation based on penetration and deposition
Site 1

Natural vegetation under a forest stand at
Camp Blanding Joint Training Center, Starke, FL

Treatment Key
S1 Spectrum Electrostatic
S2 Electrostatic Nozzle on Stihl
S3 Electrolon
S4 Buffalo Turbine
S5 Stihl 420
Site 2

Treatment Key
S1 Spectrum Electrostatic
S2 Electrostatic Nozzle on Stihl
S3 Electrolon
S4 Buffalo Turbine
S5 Stihl 420
Buffalo Turbine mist sprayer (BUTU).

Truck/trailer mounted.
Four Teejet 8502 nozzles in a cluster
Flow rate up to 37.9 l/min
Electrolon BP-2.5TM (ELEC)

• electrostatic mist blower

• Battery operated induction charge nozzle.

• Flow rate 194 ml/min.
Spectrum Electrostatic Sprayer (SETM).

- Truck-mounted electrostatic mist sprayer
- Droplet charging by conduction
- Flow rate up to 26.5 l/min
Stihl 420 (STHL)

Backpack mist blower

Flow rate: 0.14 – 3.0 l/min.
Spectrum Electrostatic Nozzle on Stihl
(SENS)
## Weather Conditions

<table>
<thead>
<tr>
<th>Sprayer</th>
<th>Wind Speed (Range), km/h</th>
<th>Temperature (Range), °C</th>
<th>R.H. (Range), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUTU</td>
<td>1.2 (0.0 – 2.4)</td>
<td>29.7 (28.2 – 31.1)</td>
<td>59 (50 – 69)</td>
</tr>
<tr>
<td>ELEC</td>
<td>1.9 (1.5 – 2.4)</td>
<td>29.5 (28.3 – 30.8)</td>
<td>60 (49 – 71)</td>
</tr>
<tr>
<td>SENS</td>
<td>0.7 (0.0 – 1.5)</td>
<td>30.1 (28.3 – 32.0)</td>
<td>61 (53 – 69)</td>
</tr>
<tr>
<td>SETM</td>
<td>3.9 (3.9 – 4.0)</td>
<td>29.7 (28.0 – 31.4)</td>
<td>61 (49 – 73)</td>
</tr>
<tr>
<td>STHL</td>
<td>2.7 (0.8 – 3.7)</td>
<td>29.9 (27.2 – 32.3)</td>
<td>63 (49 – 72)</td>
</tr>
</tbody>
</table>
Spray Material

• TalstarTM (7.9 % Bifenthrin)

• Application rates of 21.8 ml/300 m of treated row

• Caracid Brilliant Flavine FFS fluorescent dye
## Application parameters and Tank Mixes

<table>
<thead>
<tr>
<th>Sprayer</th>
<th>Flow rate L/min</th>
<th>Travel Speed km/h</th>
<th>Insecticide ml/L</th>
<th>Dye g/L</th>
<th>Sprayer Air Velocity (m/s) 61 cm away</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUTU</td>
<td>4.67</td>
<td>8.0</td>
<td>2.11</td>
<td>1.91</td>
<td>30.5</td>
</tr>
<tr>
<td>ELEC</td>
<td>0.20</td>
<td>3.2</td>
<td>19.70</td>
<td>17.77</td>
<td>0.7</td>
</tr>
<tr>
<td>SENS</td>
<td>0.84</td>
<td>3.2</td>
<td>4.69</td>
<td>4.23</td>
<td>29.3</td>
</tr>
<tr>
<td>SETM</td>
<td>6.75</td>
<td>8.0</td>
<td>1.46</td>
<td>1.32</td>
<td>31.0</td>
</tr>
<tr>
<td>STHL</td>
<td>2.77</td>
<td>3.2</td>
<td>1.42</td>
<td>1.28</td>
<td>30.3</td>
</tr>
</tbody>
</table>
Hotwire Droplet Sizing
# Droplet Characteristics

<table>
<thead>
<tr>
<th>Sprayer</th>
<th>$DV_{0.1}$ (µm ± SD)</th>
<th>$DV_{0.5}$ (µm ± SD)</th>
<th>$DV_{0.9}$ (µm ± SD)</th>
<th>% Vol &lt;50 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUTU</td>
<td>97.0 ± 28.1</td>
<td>204.7 ± 56.9</td>
<td>375.5 ± 98.7</td>
<td>2.3 ± 2.1</td>
</tr>
<tr>
<td>ELEC</td>
<td>12.9 ± 3.9</td>
<td>49.7 ± 18.8</td>
<td>117.9 ± 36.7</td>
<td>50.7 ± 13.0</td>
</tr>
<tr>
<td>SENS</td>
<td>53.3 ± 6.9</td>
<td>135.4 ± 10.0</td>
<td>216.0 ± 44.2</td>
<td>8.7 ± 2.6</td>
</tr>
<tr>
<td>SETM</td>
<td>80.7 ± 4.1</td>
<td>186.3 ± 4.7</td>
<td>414.7 ± 110.1</td>
<td>4.2 ± 1.1</td>
</tr>
<tr>
<td>STHL</td>
<td>63.3 ± 14.8</td>
<td>162.7 ± 32.6</td>
<td>285.9 ± 126.8</td>
<td>7.0 ± 2.9</td>
</tr>
</tbody>
</table>
Sampling Locations

Sprayer Travel and spray discharge direction

Line A

Line B
2 leaves collected at 1 & 2 m heights

Line D
10-20 m

Line C

> 15 m

Road

0 1 3 5 m

2 leaves collected at 1 & 2 m heights

10-20 m

> 15 m
Leaf Washing
Mean Deposition

- Top of leaf
- Bottom of leaf

Sprayers

- BUTU
- ELEC
- SENS
- SETM
- STHL
Penetration

Canopy depth, m
CONCLUSIONS

• Sprayers producing larger droplets proved significantly better.

• Sprayers with higher air velocity at the nozzle discharge proved significantly better.

• Electrostatic sprayers have no improvement over the conventional sprayers.

• No difference between truck mounted and back pack sprayers. => Selection based on area to be treated.
ACKNOWLEDGMENTS

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