ESS Air-Assisted Electrostatic Sprayers for Field Crops

This recent case study was done to compare season-long pesticide expenses of a grower who uses both ESS and conventional sprayers on the same type of crop. The ESS application rate of chemical was generally 50% less than that of conventional sprayers. Additional savings came from one less application needed for insecticides on the ESS sprayer-treated fields.

### Case Studies 1999

<table>
<thead>
<tr>
<th>Crop: Specialty Lettuce</th>
<th>Acres: 275</th>
<th>Grower: Central Valley, Merced, CA.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conventional Sprayer:</strong> 6 applic.</td>
<td><strong>Chemical usage</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Applications</td>
<td>Chemical rate per 275 acres</td>
<td>Chemical cost per 275 acres</td>
</tr>
<tr>
<td>2 Lannate 0.9 lbs. 400 lbs.</td>
<td>$10,865</td>
<td></td>
</tr>
<tr>
<td>1 Monitor 2 pts. 138 gals.</td>
<td>$11,216</td>
<td></td>
</tr>
<tr>
<td>1 Pounce 0.75 lbs. 306 lbs.</td>
<td>$12,360</td>
<td></td>
</tr>
<tr>
<td>2 Success 3 oz. 30 gals.</td>
<td>$10,625</td>
<td></td>
</tr>
<tr>
<td>1 Mic.nutrients 4 pts. 1020 gals.</td>
<td>$10,300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1285 gals.</td>
<td>$68,254</td>
</tr>
<tr>
<td><strong>ESS Air/Electrostatic Sprayer:</strong> 5 applic.</td>
<td><strong>Chemical usage</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Applications</td>
<td>Chemical rate per 275 acres</td>
<td>Chemical cost per 275 acres</td>
</tr>
<tr>
<td>1 Lannate 0.4 lbs. 110 lbs.</td>
<td>$2,414</td>
<td></td>
</tr>
<tr>
<td>1 Monitor 1 pts. 34 gals.</td>
<td>$2,764</td>
<td></td>
</tr>
<tr>
<td>1 Pounce 0.5 lbs. 138 lbs.</td>
<td>$8,280</td>
<td></td>
</tr>
<tr>
<td>2 Success 4 oz. 17 gals.</td>
<td>$11,000</td>
<td></td>
</tr>
<tr>
<td>1 Mic.nutrients 3.5 pts. 600 gals.</td>
<td>$6,000</td>
<td></td>
</tr>
<tr>
<td>683 gals.</td>
<td>$32,655</td>
<td></td>
</tr>
</tbody>
</table>

### Season savings: 682 gals. of pesticide formulation and $35,599 in costs

Significant improvements have been made in the charging and reliability of electrostatic spray-charging nozzles. This graph shows charging levels achieved while spraying heavy mixtures of electrically conductive fungicides. The new MaxCharge™ nozzle from ESS produced the highest and most consistent charging levels.

### Charging Performance Comparisons of Air-Assisted Electrostatic Spray Nozzles

**ESS Air-Assisted Electrostatic Sprayer:** Chemical expense: $32,655
Cost per acre: $119

**Conventional Sprayer:** Chemical expense: $68,254
Cost per acre: $248

### Significant improvements

Significant improvements have been made in the charging and reliability of electrostatic spray-charging nozzles. This graph shows charging levels achieved while spraying heavy mixtures of electrically conductive fungicides. The new MaxCharge™ nozzle from ESS produced the highest and most consistent charging levels.
ESS MaxCharge™ Air-Assisted Electrostatic Sprayers

New ESS MaxCharge™ sprayers produce electrically charged spray droplets which are carried onto the plant canopy in a high-speed air stream. The charged droplets seek out plant material by electrostatic forces. The result is uniform spray coverage on hidden areas deep inside of the plant canopy, where other sprayers miss. Testing shows that the electrostatic charging effect causes 4 to 5 times more spray deposition on the plant than conventional sprayers.

The MaxCharge™ spray nozzle uses compressed air to atomize the spray and carry droplets onto the crop in a turbulent cloud. Embedded inside the nozzle tip is a special electrode that induces a high concentration of electrons onto the liquid stream. The air moves through the nozzle at nearly the speed of sound, impacting the liquid stream and shattering it into small, uniform size droplets. The electrostatically charged droplets are pushed onto the crop by air energy and the electrostatic charge causes the droplets to attract to plant surfaces instead of being blown past the target, drifting away or falling to the ground.

The MaxCharge™ nozzle is easy to disassemble and clean. The ceramic tip, stainless steel electrode and chemical resistant plastics keep the nozzle performing efficiently. Most growers get over 800 hours use from a set of nozzles.

Where does it go?

The University of California at Davis completed an extensive series of tests to investigate what happens to sprayed chemical after it leaves the nozzles. Tests were conducted comparing a conventional high-volume sprayer to the ESS sprayer. This trial consisted of spraying full season potato foliage with a tracer using various types of commercial field sprayers. Tracer deposits on target area, leaves the nozzles. Tests were conducted comparing a conventional high-volume sprayer to the ESS sprayer. This trial consisted of spraying full season potato foliage with a tracer using various types of commercial field sprayers. Tracer deposits on target areas were then sampled and weighed at the University of California at Davis and the results are shown.

Average increase in spray droplet deposit by ESS to be 10-times on top leaf surfaces and 30-times on lower leaf surfaces. Data courtesy of Cornell University, Dept. of Biological and Agricultural Engineering, Ithaca, NY.

In conclusion of this study the UC researchers stated “If the chemical rate were reduced by 3-fold, when using the ESS sprayer, the amount onto plants would be greater than the conventional sprayer at full rate. But, the amount of chemical moving off-target would be 10/10th of that of the conventional sprayer.”

Photo credit - The University of Georgia

New High-Flow MaxCharge™ Nozzle

Increased Liquid Flow Rate
The new High-Flow nozzle has nearly double the liquid flow rate of previous air-assisted electrostatic spray nozzles. Liquid output per nozzle of 150 to 190 ml/minute is now possible. The higher liquid application rate aids in better tank mixing and improves spray coverage at higher ground speeds.

Increased Air Volume Output
• Helps in crosswind conditions
• Increases charging with all chemicals

Spray Deposition on Leaf surfaces:

Droplets per sq. cm on leaf upper and lower surfaces by computer vision

The K-450 Series is available with 40 to 72 nozzles on booms from 36 to 66 feet in length.
The University of California at Davis completed an extensive series of tests to investigate what happens to sprayed chemical after it leaves the nozzles. Tests were conducted comparing a conventional high-volume sprayer to the ESS sprayer. This trial consisted of spraying full season potato foliage with a tracer using various types of commercial field sprayers. Tracer deposits on target area ground, plant, and out of immediate area were measured. Out of immediate area includes areas that are 20 to 200 ft. away from the crop line.

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The new ESS K-450 Series field sprayers:

High-flow MaxCharge™ electrostatic nozzles:
- Capable of higher liquid flow rates
- Maximum electrical charge density on the spray
- Increased air-assist power for penetration into dense canopy crops

Lobed-blower air compressor technology:
- Produces higher volumes of compressed air with less horsepower
- Uses rotating lobes rather than pistons and valves
- Smooth running and easy to maintain
- Over 500 hours maintenance interval
- Produces clean, oil-free air

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The MaxCharge™ Spray Nozzle

A unique embedded electrode at the tip induces a high level of electrostatic charge onto the spray. This causes droplets to wrap around leaves as seen below.

The MaxCharge™ Air-Assisted Electrostatic Sprayers

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The K-450 Series is available with 40 to 72 nozzles on booms from 36 to 66 feet in length.

The ESS Advantage:

The combination of optimized air-assist with high levels of electrostatic spray charge produces the highest spray transfer efficiency of any sprayer on the market. Get the most out of your chemicals at very low volume rates and cost with ESS MaxCharge™ technology.

Spray Deposition on Leaf surfaces:

Droplets per sq. cm on leaf upper and lower surfaces by computer vision

Where does it go?

Conventional Sprayer

ESS

**New High-Flow MaxCharge™ Nozzle**

**Increased Liquid Flow Rate**

The new High-Flow nozzle has nearly double the liquid flow rate of previous air-assisted electrostatic spray nozzles. Liquid output per nozzle of 150 to 190 ml/minute is now possible. The higher liquid application rate aids in better tank mixing and improves spray coverage at higher ground speeds.

**Increased Air Volume Output**

- **Ads in crop penetration**
- **Helps in crosswind conditions**
- **Increases charging with all chemicals**

**High-flow Nozzle**

The new ESS K-450 Series field sprayers:

- **High-flow MaxCharge™ electrostatic nozzles:**
  - Capable of higher liquid flow rates
  - Maximum electrical charge density on the spray
  - Increased air-assist power for penetration into dense canopy crops

**Lobed-blower air compressor technology:**

- Produces higher volumes of compressed air with less horsepower
- Uses rotating lobes rather than pistons and valves
- Smooth running and easy to maintain
- Over 500 hours maintenance interval
- Produces clean, oil-free air

**Tubular aluminum spray booms:**

- **Strong**
- **Light weight**

**Low-volume spraying:**

- **30 acres or more from a single tank fill**
ESS Air-Assisted Electrostatic Sprayers for Field Crops

This recent case study was done to compare season-long pesticide expenses of a grower who uses both ESS and conventional sprayers on the same type of crop. The ESS application rate of chemical was generally 50% less than that of conventional sprayers. Additional savings came from one less application needed for insecticides on the ESS sprayer-treated fields.

### Case Studies 1999

**Crop:** Specialty Lettuce  
**Acres:** 275  
**Grower:** Central Valley, Merced, CA.

#### Conventional Sprayer: 6 applic.

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<th>Number of Applications</th>
<th>Chemical rate per 275 acres</th>
<th>Chemical cost per 275 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lannate 0.9 lbs</td>
<td>2</td>
<td>138 lbs.</td>
<td>$ 32,216</td>
</tr>
<tr>
<td>Monitor 2 pts.</td>
<td>1</td>
<td>206 lbs.</td>
<td>$ 22,360</td>
</tr>
<tr>
<td>Pounce 0.75 lbs</td>
<td>1</td>
<td>30 lbs.</td>
<td>$ 18,625</td>
</tr>
<tr>
<td>Success 3 oz.</td>
<td>1</td>
<td>8 lbs.</td>
<td>$ 6,088</td>
</tr>
<tr>
<td>Mic.nutrients 4 pts.</td>
<td>5</td>
<td>1020 gals.</td>
<td>$ 10,350</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>$ 68,254</td>
</tr>
</tbody>
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#### Conventional Sprayer: Chemical expense: $68,254  
Cost per acre: $248

#### ESS Air/Electrostatic Sprayer: 5 applic.

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<tr>
<td>Lannate 0.6 lbs</td>
<td>1</td>
<td>110 lbs.</td>
<td>$ 2,414</td>
</tr>
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<td>Monitor 1 pts.</td>
<td>1</td>
<td>24 gals.</td>
<td>$ 2,764</td>
</tr>
<tr>
<td>Pounce 0.5 lbs</td>
<td>1</td>
<td>138 lbs.</td>
<td>$ 6,080</td>
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<td>Success 4 oz.</td>
<td>1</td>
<td>17 gals.</td>
<td>$ 11,050</td>
</tr>
<tr>
<td>Mic.nutrients 3.5 pts.</td>
<td>5</td>
<td>600 gals.</td>
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<td><strong>Total</strong></td>
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#### ESS Air/Electrostatic Sprayer: Chemical expense: $32,655  
Cost per acre: $119

*Season savings: 652 gals. of pesticide formulation and $35,599 in costs

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**Charging Performance Comparisons of Air-Assisted Electrostatic Spray Nozzles**

*ESS Air-Electrostatic Sprayer: New ESS MaxCharge™ nozzle  
Other nozzle versions: * spray liquid 28 ohm cm  
* 20% fungicide in water  
* 82% applied in water  
* spray liquid 100 ohm cm  
* 10% fungicide in water  

K-450 Series

Electrostatic Spraying Systems, Inc.

P.O. Box 151 • Watkinsville, GA 30677 • (706) 769-0025

www.maxcharge.com
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<tr>
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<td>1 Provado 0.75 lbs.</td>
<td>306 lbs.</td>
<td>$ 12,360</td>
<td></td>
</tr>
<tr>
<td>2 Success 3 oz.</td>
<td>30 gals.</td>
<td>$ 16,625</td>
<td></td>
</tr>
<tr>
<td>1 Proxide 3.8 oz.</td>
<td>8 gals.</td>
<td>$ 4,098</td>
<td></td>
</tr>
<tr>
<td>5 Mic nutrients 6 pts.</td>
<td>1000 gals.</td>
<td>$ 10,390</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>1285 gals.</strong></td>
<td><strong>$ 68,254</strong></td>
<td></td>
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Conventional Sprayer: Chemical expense: $ 68,254 Cost per acre: $ 248

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