# Optimizing IPM Programs for Spotted Wing Drosophila in Blueberries

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## ABSTRACT

Georgia is the top blueberry producing state in the U.S. with an annual farm gate value of $255 million and economic impact of $1 billion on the state economy. Spotted wing drosophila (SWD), an invasive pest from Asia, has recently emerged as a devastating pest of blueberries and has caused significant losses in crop yield (as high as 100%) and quality. Management is achieved primarily through preventative insecticide applications. Growers make as many as twice weekly applications to protect berries from SWD infestation, which may not be possible without achieving complete coverage of all surfaces of the berries. Blueberry growers employ a wide range of technologies to apply insecticides but the level of coverage achieved by those specific technologies has yet to be evaluated. In order to optimize effectiveness of insecticide applications against SWD, it is extremely important to understand the level of coverage achieved by those technologies and whether or not it is sufficient to protect fruit from SWD infestation. We conducted studies to compare spray coverage achieved by sprayers most commonly used by blueberry growers, residue deposition on the fruit, and effectiveness of the spray residues against SWD. Spray coverage was uneven in different sections of the blueberry bush canopy in all treatments. The electrostatic sprayer deposited less residues on the fruit surface and resulted in lower SWD mortality in semi-field bioassays as compared to airblast, air cannon, and overhead boom sprayer. These results show that spray coverage needs to be improved which can be achieved by frequent calibration. Specifically, educating growers on how to properly calibrate and use new spray technologies such as electrostatic sprayers will be extremely important.

## MATERIALS AND METHODS


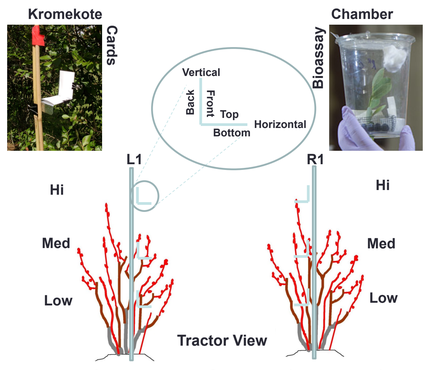


**Fig. 1.** Placement of Kromekote cards in blueberry bush canopy.

This study was conducted in rabbiteye blueberries at Blueberry Research and Demonstration Farm in Alma, GA to compare efficiency of airblast, overhead boom, airtec cannon, and electrostatic sprayer. The selected sprayers were used to apply zeta-cypermethrin at label rate in treatment plots (10 bushes X 2 rows) and Vision Pink Foam Marker Dye was added to the spray solution. In each plot, Kromekote cards were set up at three levels within the canopy on both left and right sides of the sprayers as shown in Fig. 1. Treatments were laid out in a randomized complete block design and replicated three times. Immediately after spray application, Kromekote cards were collected and analyzed using Droplet Scan program to determine percent coverage. To determine spray residues, 100 blueberries were randomly collected from each plot at 0, 3, 7, and 10 days after treatment (DAT) and analyzed for zeta-cypermethrin residues using the QuEChERS Multi-Residue Method. Semi-field bioassays were conducted to determine toxicity of spray residues to SWD by collecting a small branch containing approximately 10 leaves and 5 ripe berries from each plot at 1, 3, and 7 DAT. Data were analyzed using ANOVA (PROC MIXED in SAS v. 9.4) and Tukey-Kramer adjustment for multiple comparisons was used to separate means (α=0.05).

## RESULTS

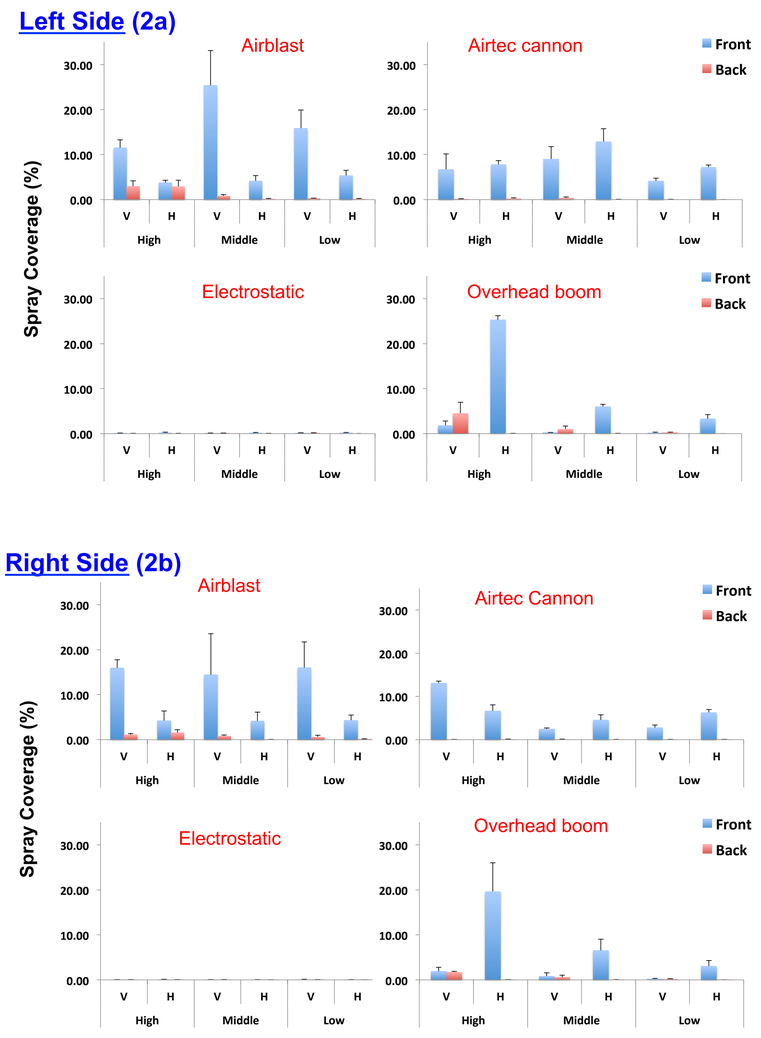


**Fig. 2a & 2b.** Spray coverage (%) achieved by different sprayers

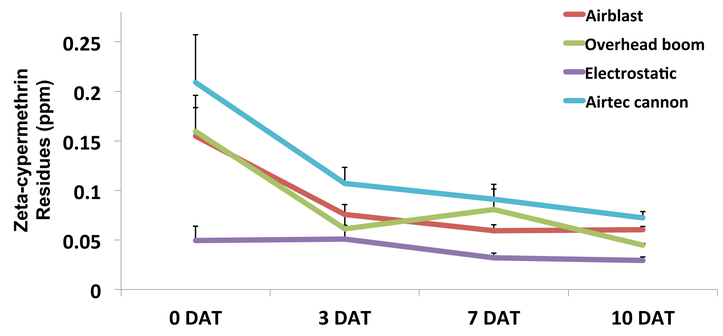


**Fig. 3.** Zeta-cypermethrin residues when applied using different sprayers

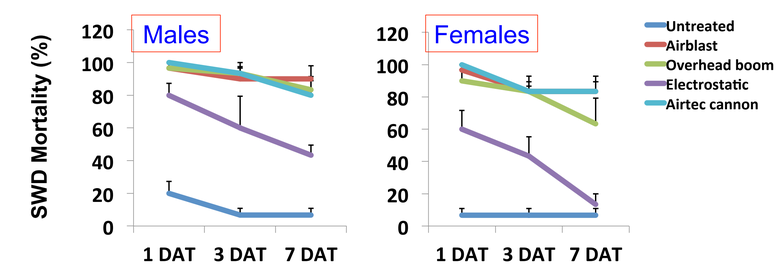


**Fig. 4.** SWD mortality as a result of zeta-cypermethrin application using different sprayers

### Spray Coverage:

Overall, electrostatic spray system provided significantly less coverage than other sprayers (Fig. 2a & 2b). The coverage provided by the rest of the sprayers was significantly variable in different parts of the canopy. The airblast sprayer provided maximum coverage on cards set up at the front side of vertical surface on the L-shaped cardholders whereas cards on the back side of the vertical surface received very low coverage. However, cards set up on both top and bottom sides of the horizontal surface received very low coverage. The overhead boom sprayer provided maximum coverage on the top-horizontal cards which gradually decreased from high to low level in the canopy. The rest of the surfaces received very low coverage. The airtec cannon sprayer provided fairly uniform coverage at the front and top cards across all levels in the canopy, and very low coverage on cards set up at the back and bottom sides.

### Spray Residues:

Application of zeta-cypermethrin using electrostatic spray system resulted in significantly lower level of residues on treated blueberries than the other sprayers at 0 DAT ($p = 0.0203$) (Fig. 3). Although the residue levels declined over time in plots treated using all sprayers ($p = <0.0001$), the level of residues in plots treated with electrostatic sprayer remained consistently lower than those treated with other sprayers at 3, 7, and 10 DAT.

### SWD Mortality:

Application of zeta-cypermethrin with all sprayers resulted in significantly higher mortality than untreated control ($p = <0.0001$) (Fig. 4). Of all the sprayers tested in this study, electrostatic spray system provided lowest mortality of both male and female SWD at 1 DAT. Residual activity of zeta-cypermethrin when applied using airblast, overhead boom, and airtec cannon sprayers remained consistently high even at 7 DAT whereas it significantly dropped after 3 DAT for both male and female SWD. At 7 DAT, SWD female mortality in plots treated using electrostatic spray system was not significantly different from the untreated control.

## CONCLUSIONS

Our results clearly indicate that commonly used sprayers provide uneven coverage in different sections of blueberry bush canopy which might leave opportunity for SWD females to oviposit in the fruit even after spray application. Particularly, the electrostatic spray system provided significantly less coverage, residue deposition, and SWD mortality than rest of the sprayers. In order to ensure protection of fruit from SWD infestation, it is extremely important to improve spray coverage which can be done by frequent calibration and proper use of different sprayers according to manufacturer recommended standards. The electrostatic spray system is an innovative approach to delivering pesticides while using significantly low volumes of water and causing less drift than other commonly used sprayers. However, it is fairly new technology and further research and demonstration programs are needed to educate growers on how to properly calibrate and use this technology.

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1785