# Spray Coverage Efficacy of a Prototype Solid Set Canopy Delivery System In High Density Apples

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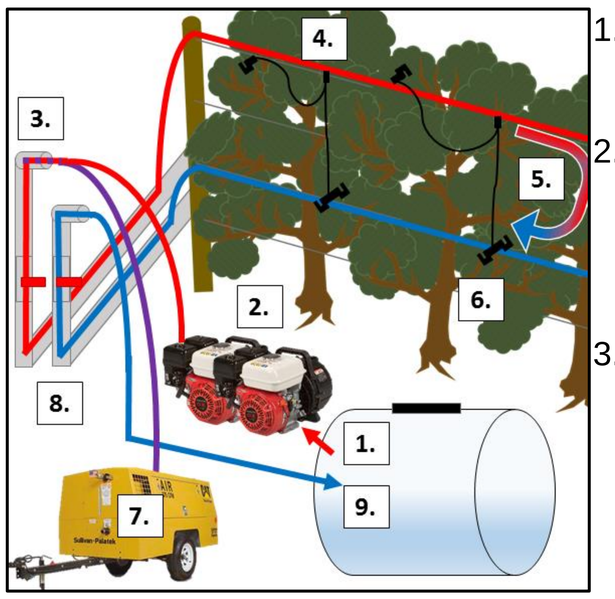
OPM

## Introduction

Apple production has undergone a revolution –we have moved from large, spherical canopies to trellised, fruiting wall styles of orchards. Chemical delivery methods, however, have not kept pace: *most growers still rely on heavy, tractor driven airblast sprayers.* We have been developing a prototype Solid Set Canopy Delivery System (SSCDS) optimized for high density apple plantings. SSCDS utilize existing trellis systems to distribute microsprayers throughout the canopy. SSCDS provide many potential benefits including:

- Rapid deployment of sprays <15 s per SSCDS set
- Ability to spray under tractor impassable conditions
- Potential for canopy cooling to reduce sunburn
- Reduced carbon footprint
- Reduced spray drift and noise

## Schematic




1. Spray material in a holding tank
2. Material pumped from tank to manifold at <30psi
3. Material pumped from manifold to 2” PVC lateral lines that feed into a 1” PE delivery line
4. Delivery lines filled with liquid
5. Material pumped until the return line (in blue) is purged of air and liquid begins to flow back into holding tank.
6. Return valve is closed, and pumps increase pressure to ~60 psi, overcoming the 35psi ‘stop drip’ device. Material is sprayed through microsprayers for 10 seconds
7. Return valve is opened, and air compressor fills lines with air, pushing residual material through.
8. Excess material flows through return line and exits the manifold back to holding tank.
9. Holding tank is refilled and air pressure is increased to purge the remnants of spray from the line.

## Acknowledgements

USDA

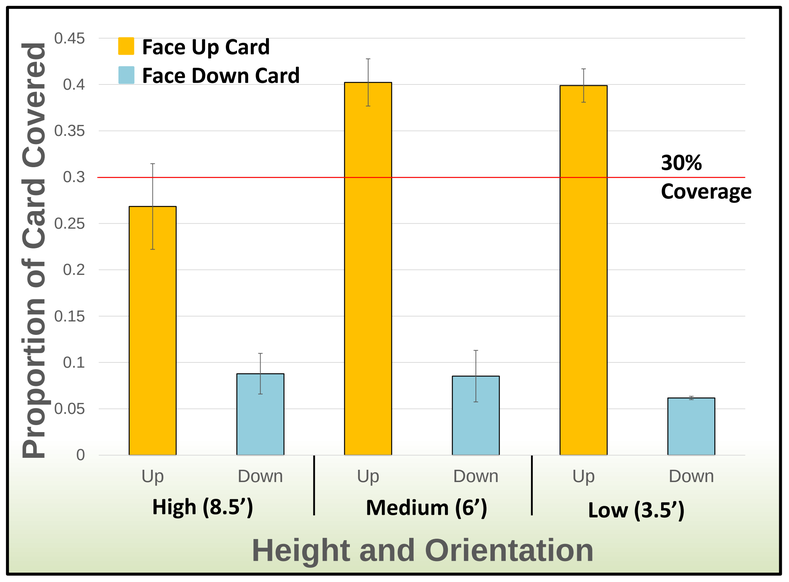
MICHIGAN APPLES GREAT LAKES, GREAT FLAVORS

**We would like to thank project GREEEN, the Michigan Apple Committee, Trickle-EEZ, and USDA SCRI for their support, as well as the many people who guided and worked on this project- John Nye, Mike Mueller, Jake Malsch, Dan Platte, Jerry Skeltis, and Denise Ruwersma**

Project GREEEN

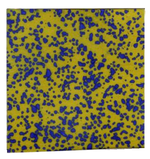
TRICKL-EEZ COMPANY

## Coverage

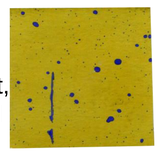



A graph of the average coverage across all four plots at each height and orientation, with a red line at 0.30 covered, considered adequate coverage for most agrochemicals (Holownicki, R. et al. (2002)

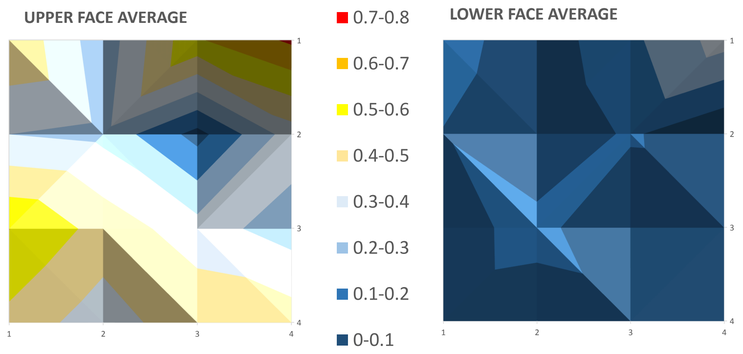
Data recorded 2015



Two representative spray cards. ~40% coverage on the left, similar to the average upper facing card. ~7% coverage on the right, similar to the average downward facing card



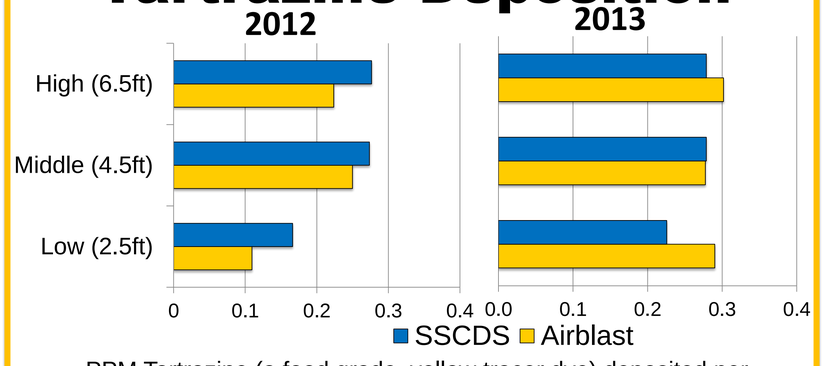
## SSCDS Spatial Coverage




Spatial graph of proportion coverage at 6ft., averaged across four sampled plots. Data recorded from Clarksville 2015.

- **Six sets of paired water sensitive cards (face up and face down) were sprayed with water and a nonionic surfactant, simulating coverage on a leaf surface**
- **Significantly higher coverage on upwards facing spray cards compared to downwards facing cards at each sampling height**
- **Highest observed coverage was on the upwards facing spray cards at 6ft and 3.5ft sampling heights- the middle and lower canopy of an ~11ft tree**
- **Adequate coverage for most agrochemicals on upper card surfaces, but not on lower surfaces**
- **Tracer dye deposition rate is similar in both systems**

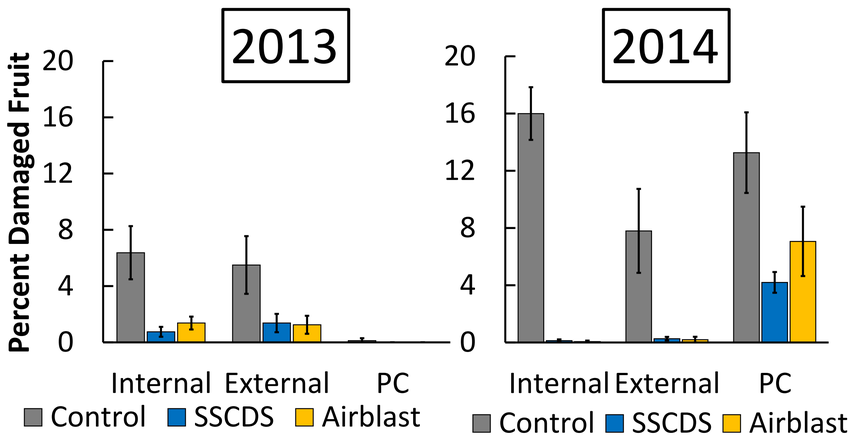
## Tartrazine Deposition




PPM Tartrazine (a food grade, yellow tracer dye) deposited per $cm^2$ on sampled leaves from 2012 and 2013.

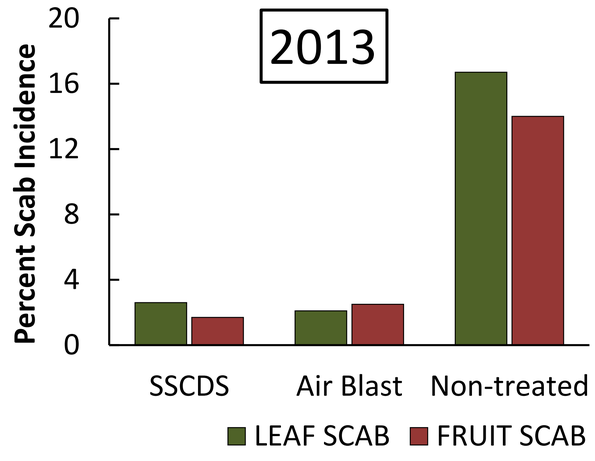
## Pest Management

- **Damage from internally feeding pests, externally damaging pests, and plum curculio was significantly higher in both years in the untreated control than in the airblast and SSCDS**
- **Damage in the SSCDS and Airblast plots was comparable in both years, implying equivalent protection.**
- **Percent of fruit damaged by internally and externally feeding pests(excluding plum curculio) was less than 2% in both the SSCDS and Airblast**




Percent of damaged fruit from an untreated control, SSCDS treated apples, and airblast treated apples from Clarksville Research Center in 2013 and 2014. Damage was categorized as **internal** (i.e. Codling Moth and Oriental fruit moth), **external** (leafroller, stinkbug), or **PC** (Plum Curculio)

- **At MSU CRC the SSCDS provided comparable scab control to the airblast sprayer applying at the same rate, time, and product**
- **Significantly higher scab damage was observed in the untreated control when compared to both the SSCDS and airblast**




Percent damaged fruit from an untreated control, SSCDS treated apples, and airblast treated apples from Clarksville Research Center in 2013 and 2014. Damage was categorized as **leaf scab** or as **fruit scab**

## Next Steps

- Test SSCDS coverage at a season-long scale, at different points in canopy development
- Research how accurately a lightmeter measuring photosynthetically active radiation can predict coverage at different levels in the canopy
- Begin development of next prototype iteration with MSU Engineering and Trickle-eez

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