# How to fill in the Priorities Survey

| *(Please select the top 5 in each category and give each a unique rank from 1 to 5; 1 = highest)* | **2015 Ranking** |
|---|---|
| **General IPM Issues** | |
| Pesticide resistance | |
| Invasive/exotic species | |
| Weather/information delivery systems | |
| Cost reduction | |
| Pollinator conservation | |
| Organic production | |
| Pheromone technology | |
| OP/carbamate replacements | |
| Abandoned orchard impact | |
| IFP certification | |
| Groundwater monitoring | |

# How to fill in the Priorities Survey

| *(Please select the top 5 in each category and give each a unique rank from 1 to 5; 1 = highest)* | **2015 Ranking** |
|---|---|
| **General IPM Issues** | |
| Pesticide resistance | |
| Invasive/exotic species | 2 |
| Weather/information delivery systems | 4 |
| Cost reduction | 3 |
| Pollinator conservation | |
| Organic production | |
| Pheromone technology | 5 |
| OP/carbamate replacements | 1 |
| Abandoned orchard impact | |
| IFP certification | |
| Groundwater monitoring | |

# How to fill in the Priorities Survey

| *(Please select the top 5 in each category and give each a unique rank from 1 to 5; 1 = highest)* | **2015 Ranking** |
|---|---|
| **General IPM Issues** | |
| Pesticide resistance | |
| Invasive/exotic species | 2 |
| Weather/information delivery systems | 4 |
| Cost reduction | |
| Pollinator conservation | |
| Organic production | |
| Pheromone technology | 5 |
| OP/carbamate replacements | 1 |
| Abandoned orchard impact | |
| IFP certification | |
| Groundwater monitoring | |
| (write in) *How to get trap stickum out of your hair* | 3 |

# How *not* to fill in the Priorities Survey

| *(Please select the top 5 in each category and give each a unique rank from 1 to 5; 1 = highest)* | **2015 Ranking** |
|---|---|
| **General IPM Issues** | |
| Pesticide resistance | 1 |
| Invasive/exotic species | 1 |
| Weather/information delivery systems | 1 |
| Cost reduction | 1 |
| Pollinator conservation | 1 |
| Organic production | 1 |
| Pheromone technology | 1 |
| OP/carbamate replacements | 1 |
| Abandoned orchard impact | 1 |
| IFP certification | 1 |
| Groundwater monitoring | 1 |

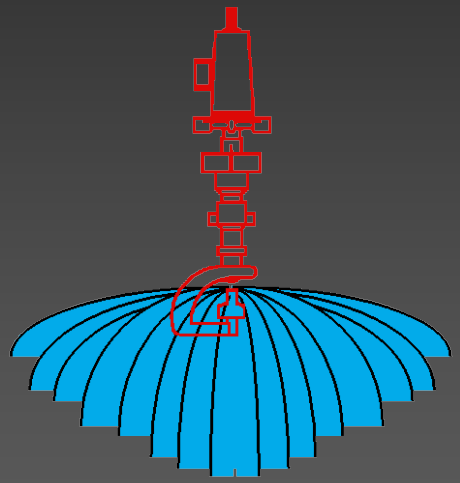
# How *not* to fill in the Priorities Survey

| *(Please select the top 5 in each category and give each a unique rank from 1 to 5; 1 = highest)* | **2015 Ranking** |
|---|---|
| **General IPM Issues** | |
| Pesticide resistance | 2 |
| Invasive/exotic species | 2 |
| Weather/information delivery systems | 1 |
| Cost reduction | 3 |
| Pollinator conservation | 2 |
| Organic production | 1 |
| Pheromone technology | 1 |
| OP/carbamate replacements | 2 |
| Abandoned orchard impact | 4 |
| IFP certification | 4 |
| Groundwater monitoring | 5 |

# How *not* to fill in the Priorities Survey

| *(Please select the top 5 in each category and give each a unique rank from 1 to 5; 1 = highest)* | **2015 Ranking** |
|---|---|
| **General IPM Issues** | |
| Pesticide resistance | 8 |
| Invasive/exotic species | 2 |
| Weather/information delivery systems | 4 |
| Cost reduction | 3 |
| Pollinator conservation | 7 |
| Organic production | 10 |
| Pheromone technology | 5 |
| OP/carbamate replacements | 1 |
| Abandoned orchard impact | 6 |
| IFP certification | 9 |
| Groundwater monitoring | 11 |

# Progress in Development of Fixed Spraying Systems in High-Density Apples and Berries




**Arthur Agnello**
**& Andrew Landers**
**Dept. of Entomology**
**Cornell University**
**New York State Agricultural Experiment Station**
**Geneva, NY  USA**

# Conventional approach to pesticide application in apple orchards

Use of airblast sprayers can be inefficient and inaccurate

- spray drift
- off-target contamination
- ineffective pest control

# Study Site for Fixed Spray Evaluation, 2007

## Fowler Farms
## Wolcott, NY

- Mature ‘Gala’ block, 0.9 A
- “Super Spindle” planting system
- Row spacing – 10 ft
- Tree spacing – 2 ft

¾-inch polyethylene tubing

- Minimal number of branch points and reductions in tubing diameter to avoid excessive pressure loss between pump and nozzles.
- Nozzles attached directly to line within row

# Lateral Line Support System

- Supply incorporated lines into tree support system
- Dual (high and low) lateral lines, sprays made from row center outwards
- No air-assist, limited canopy penetration; intended for use in high-density plantings only

# Supply Manifold Support System

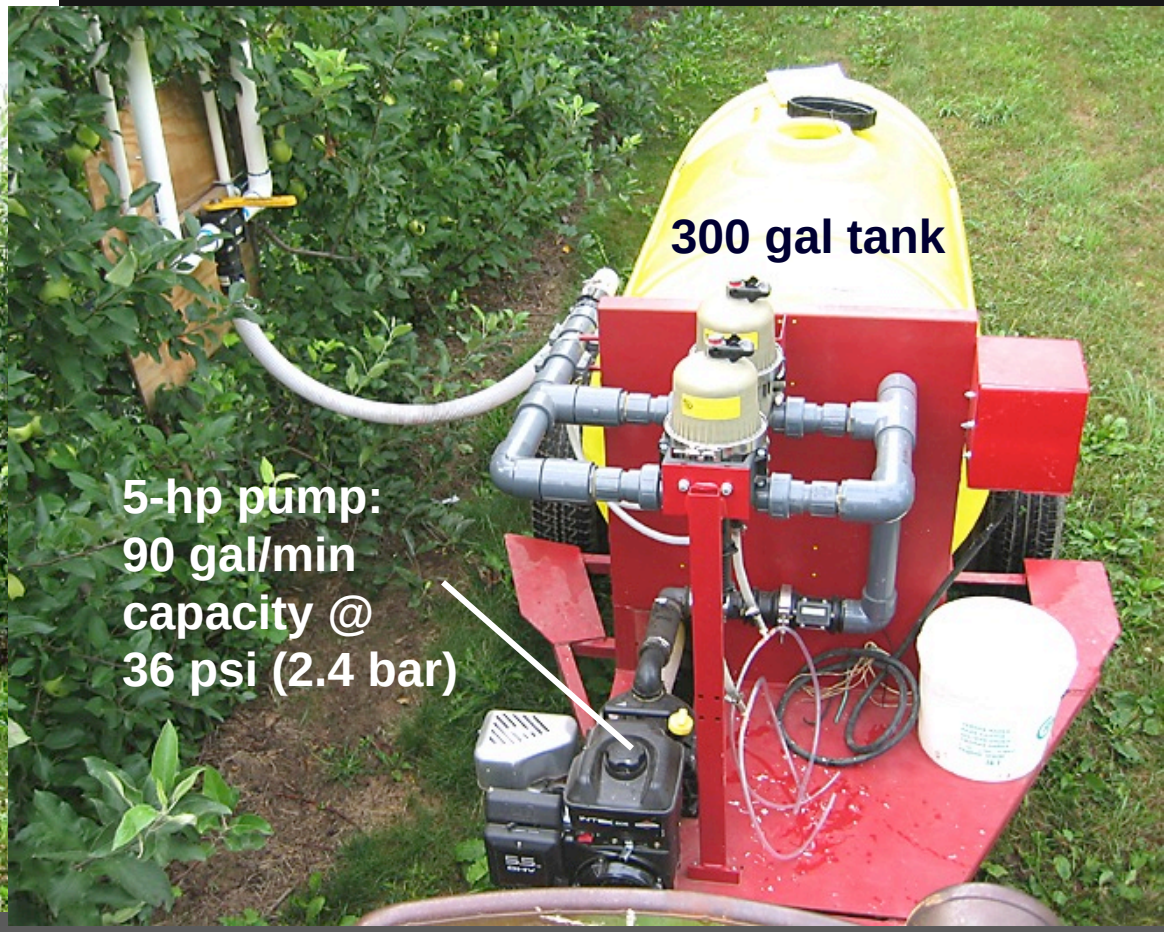
trellis support post

2-inch PVC Schedule 80 pipe

Supply line mounted overhead, using rigid PVC pipe attached to the trellis support posts

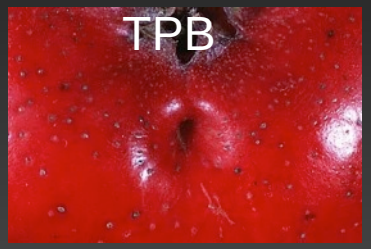
# Pesticide Injection Site

## Mobile Pumping Unit




- Could have used airblast sprayer to pump the solution, but most sprayer pumps provide ~35 gal/min; need 3x that capacity
- Mobile unit built  with tank and a suitable pump; transported to a central injection site

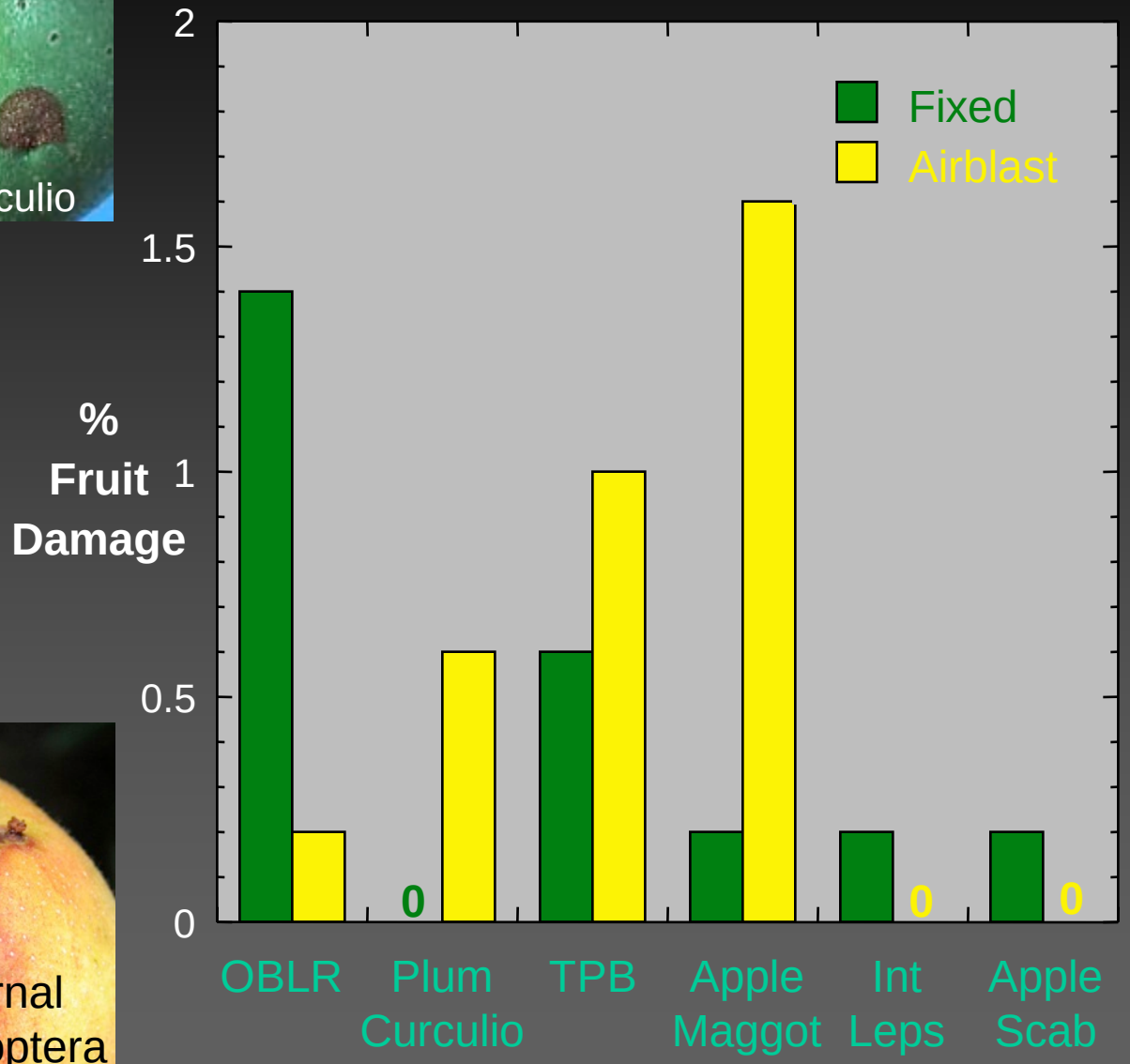








## Fruit Damage* at Harvest - 2007




* No significant differences between treatments

# Current System Modifications and Redesigns "Solid Set Canopy Delivery System" (SSCDS)

(Grant with Michigan State Univ. and Washington State Univ.)

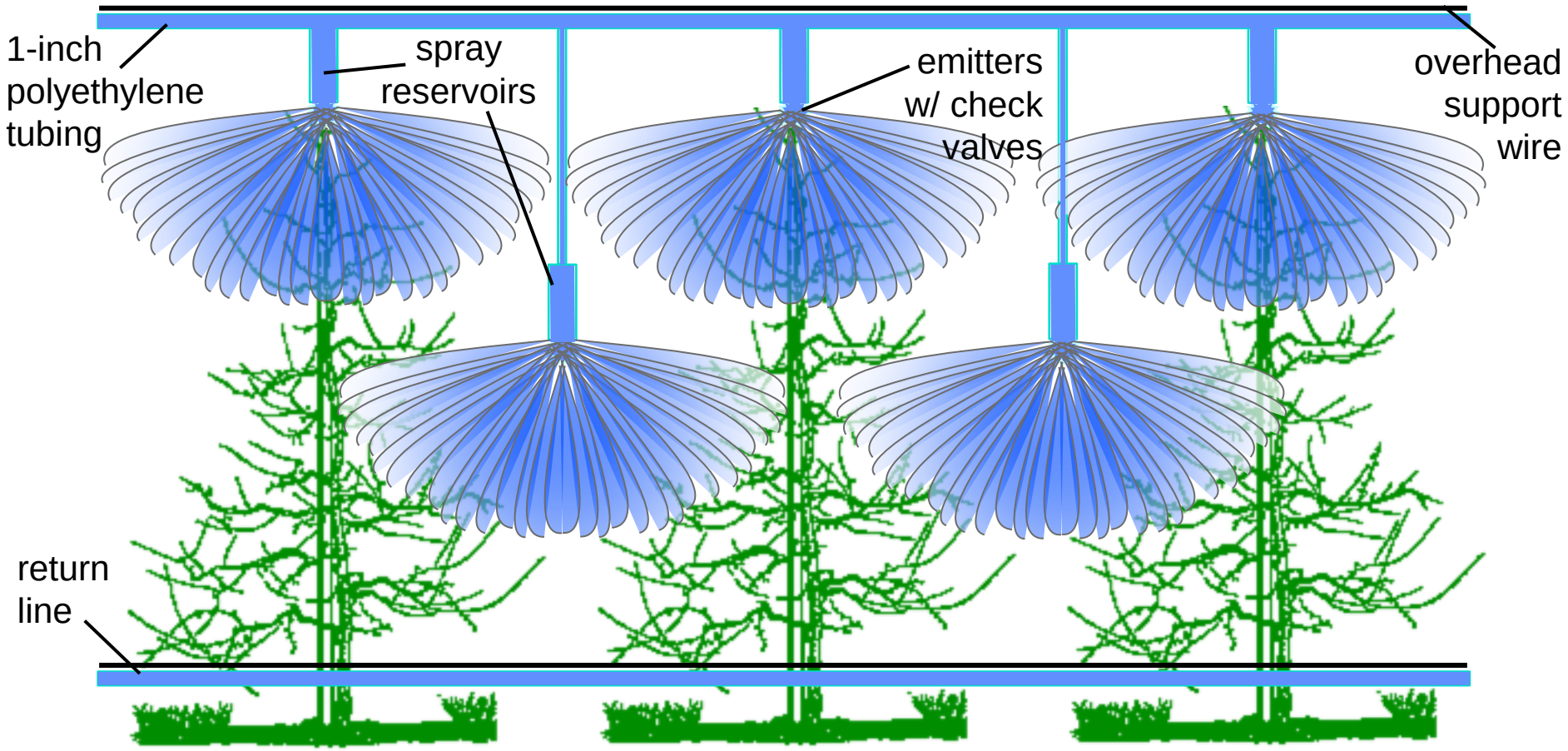
- Pressure-compensating valves and leak-prevention nozzles installed to delay and synchronize emission of sprays at a target pressure after lines have been fully charged
- Supplied each emitter with just enough spray material to adequately cover tree canopy surfaces below it
- Use compressed air to recirculate and re-capture excess spray solution, effect spray delivery, and purge residue from lines
- Spray material is delivered sequentially to small section of orchard at a time (1-2 rows; 15-30 sec each) from a pre-mixed tank, through irrigation lines fixed above each row

MICHIGAN STATE UNIVERSITY

CORNELL UNIVERSITY FOUNDED A.D. 1865

WASHINGTON STATE UNIVERSITY

# New York Design of Solid-Set Canopy Delivery System

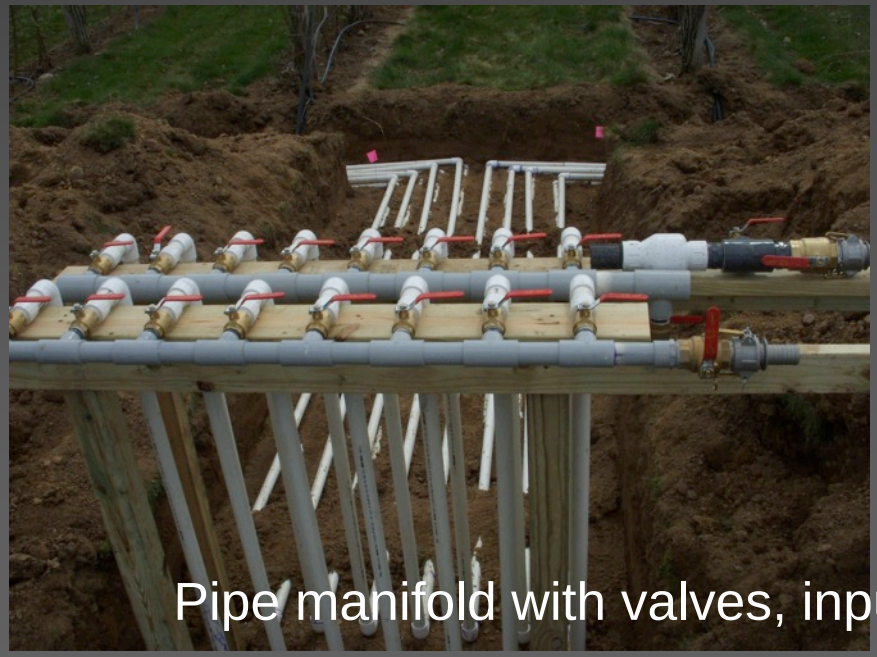


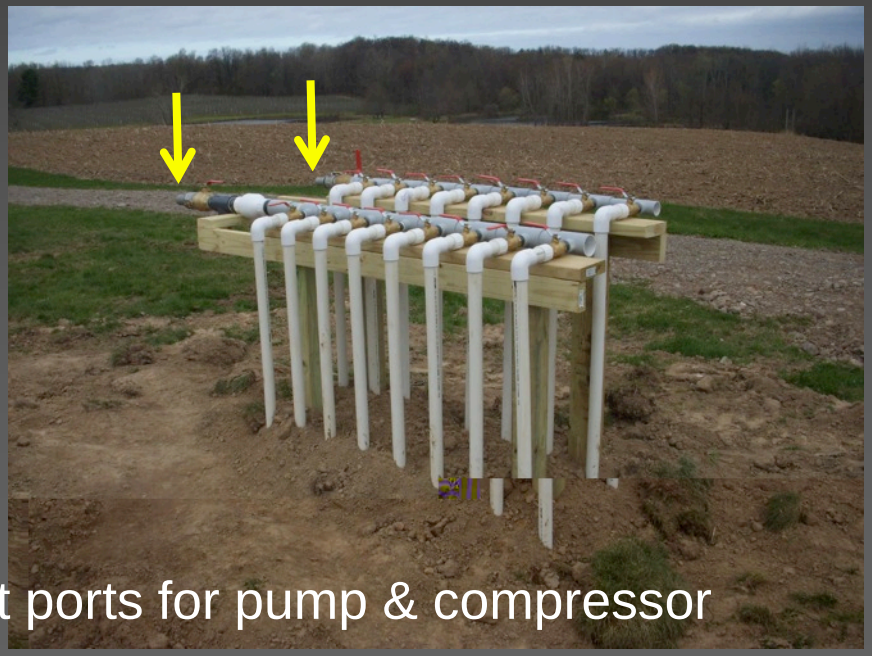

Spray Application Process

- Pump used to fill all tubes and reservoirs from tank containing mixed spray materials
- Compressed air clears main supply tubes, returns excess material to spray tank
- Compressed air at a higher pressure opens check valves, all emitters spray out pesticide solution (15 sec for ~70 gpa)

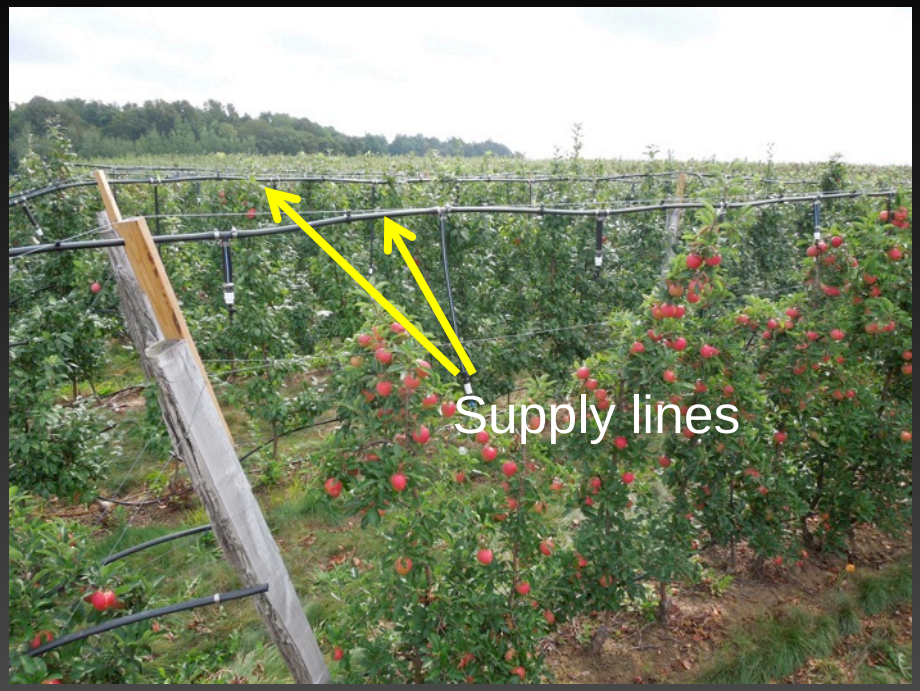
Super Spindle planting system

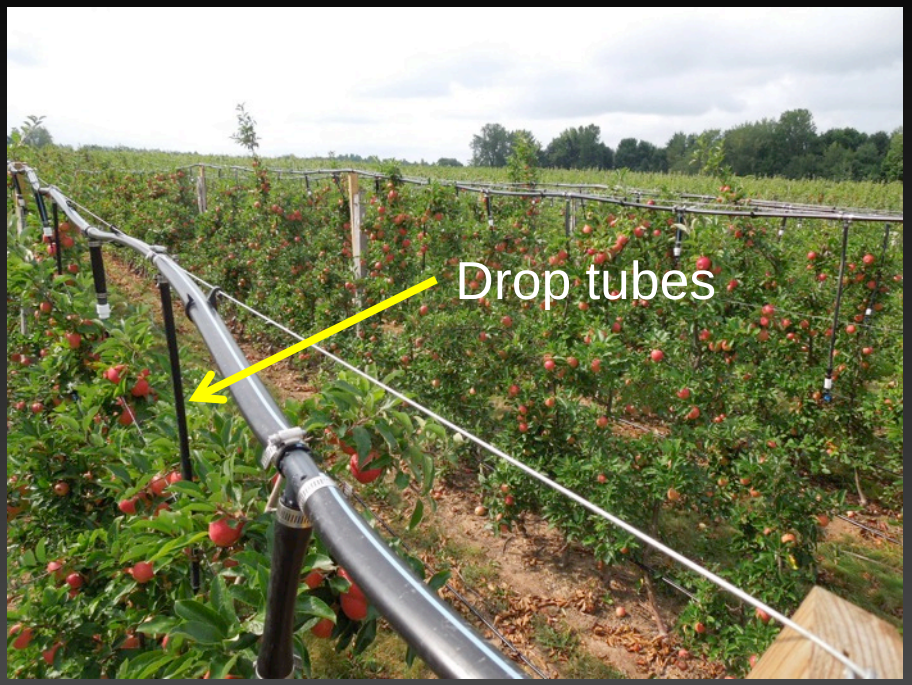
Buried PVC pipes/supply lines



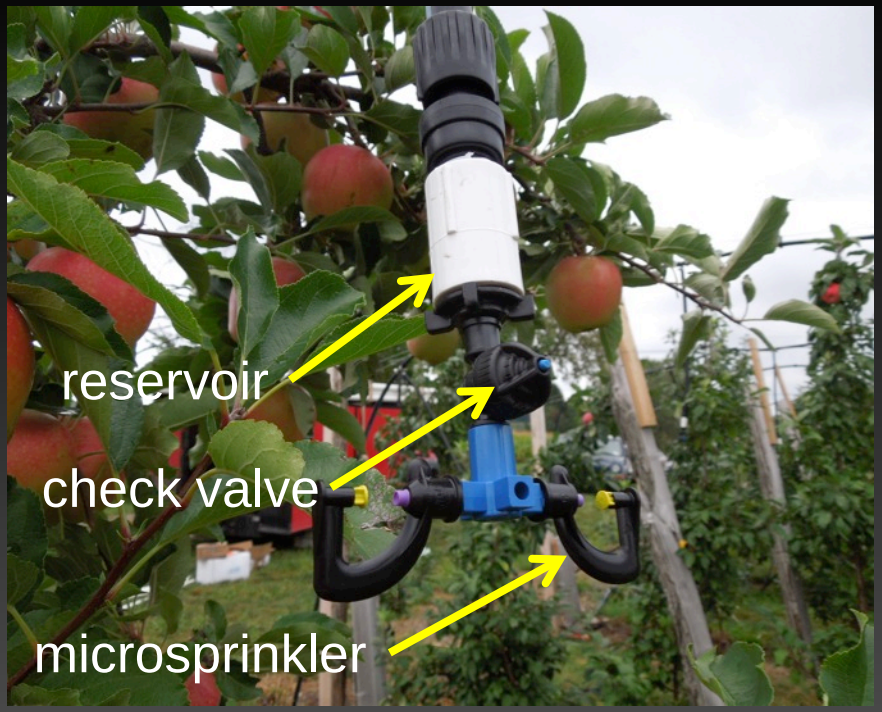


Pipe manifold with valves, input ports for pump & compressor


Supply lines


Drop tubes


reservoirs


reservoir
check valve
microsprinkler

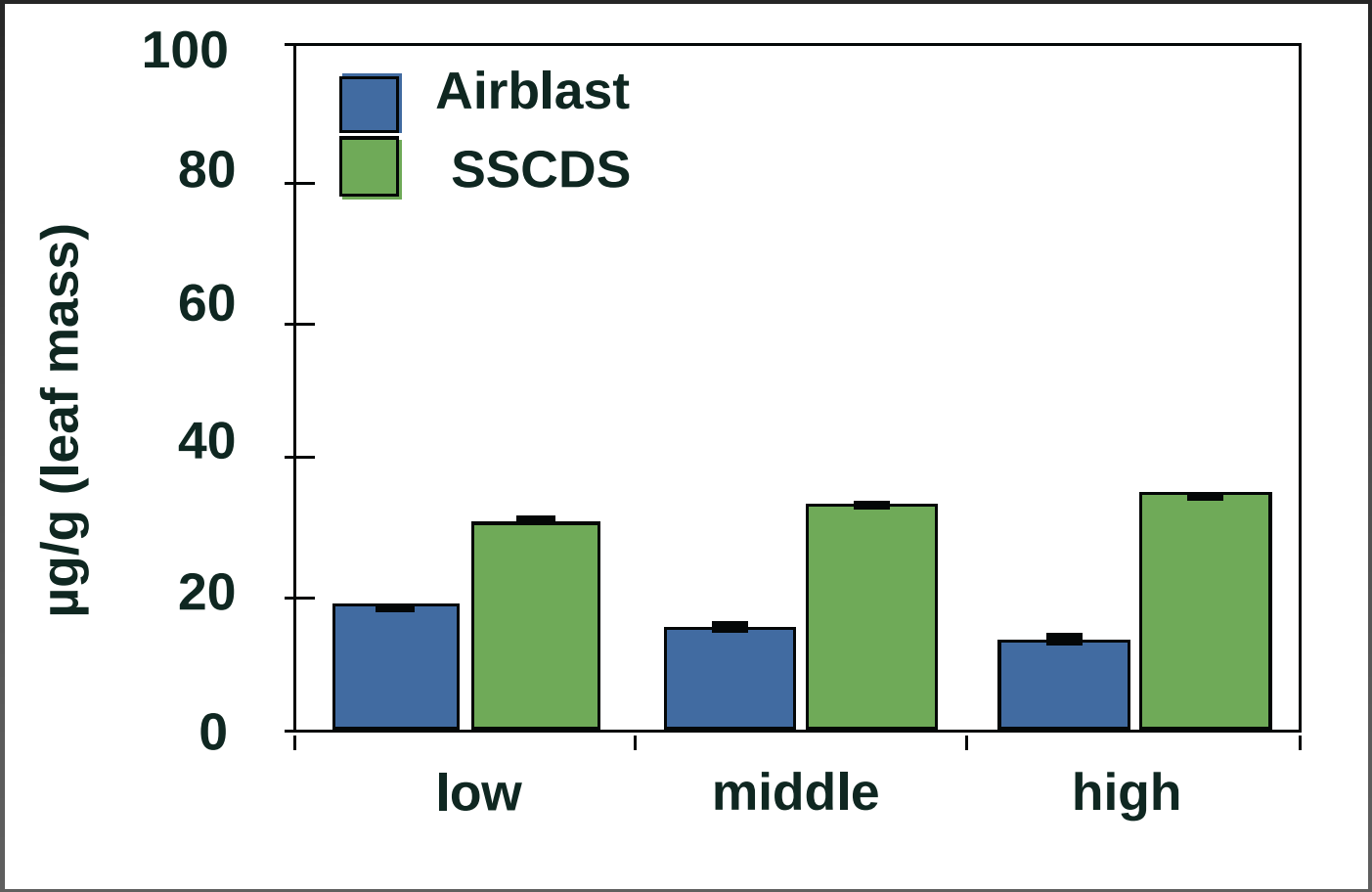
*Michigan State Univ Trials (Larry Gut)*

# Comparing SSCDS and Airblast Sprayer Coverage

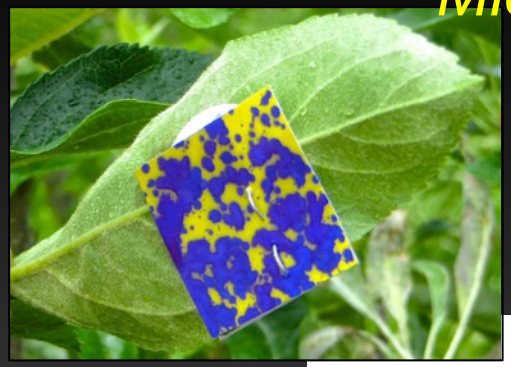
- Amount of AI deposited
- Percent surface area coverage
- Spatial distribution within the canopy
- Parallel comparison of spray deposition data to insect bioassays

*Michigan State Univ Trials (John Wise, Ron Perry)*

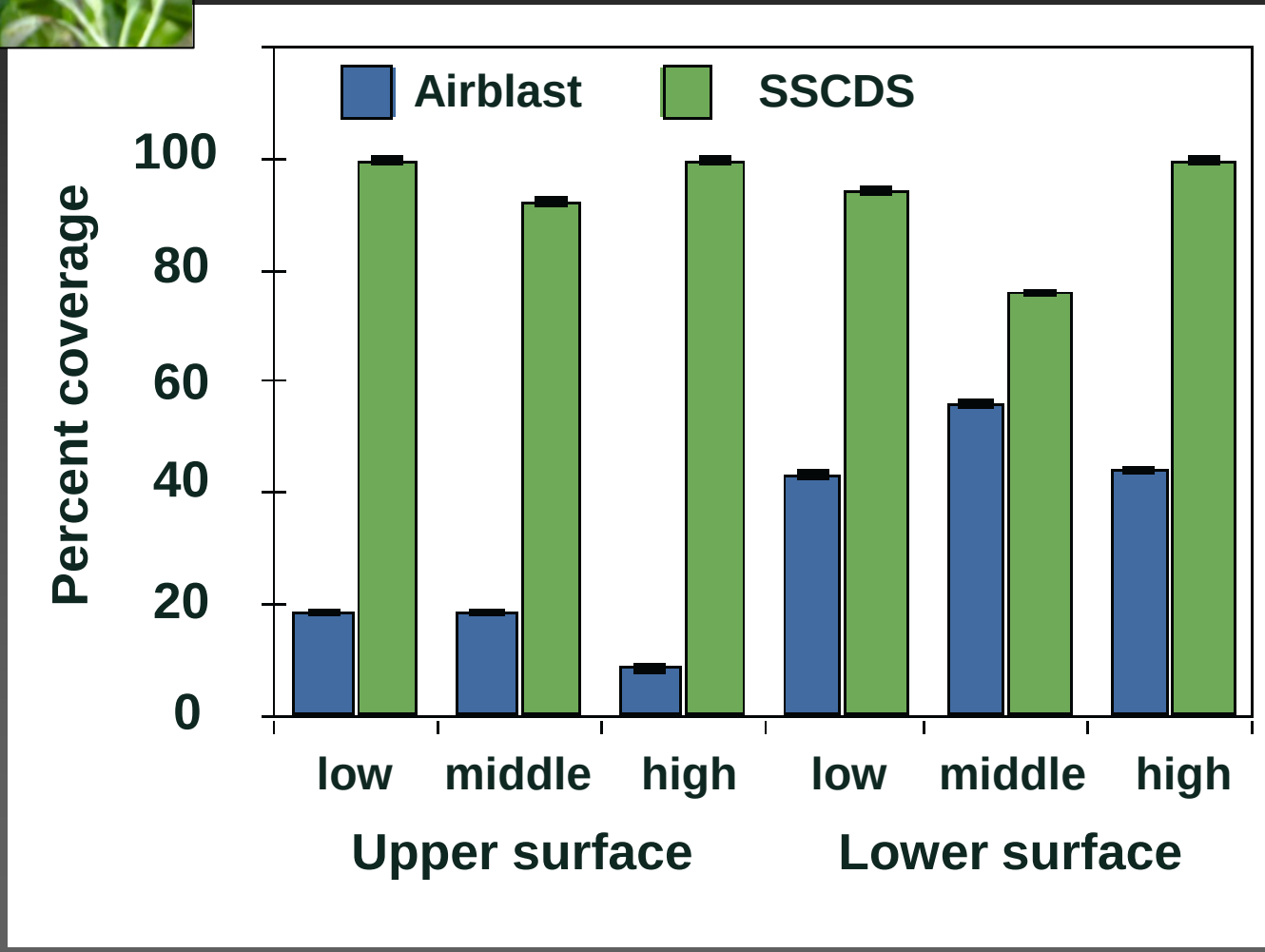
# Amount of AI deposited



*Michigan State Univ Trials (John Wise, Ron Perry)*



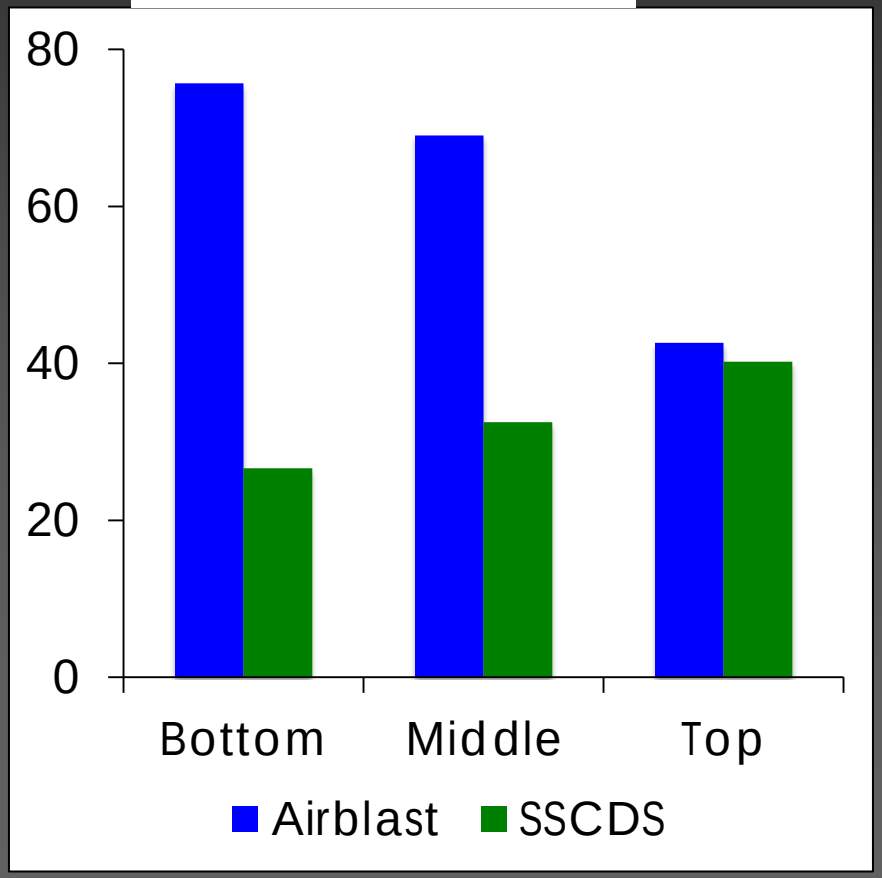
# % Surface Area Covered



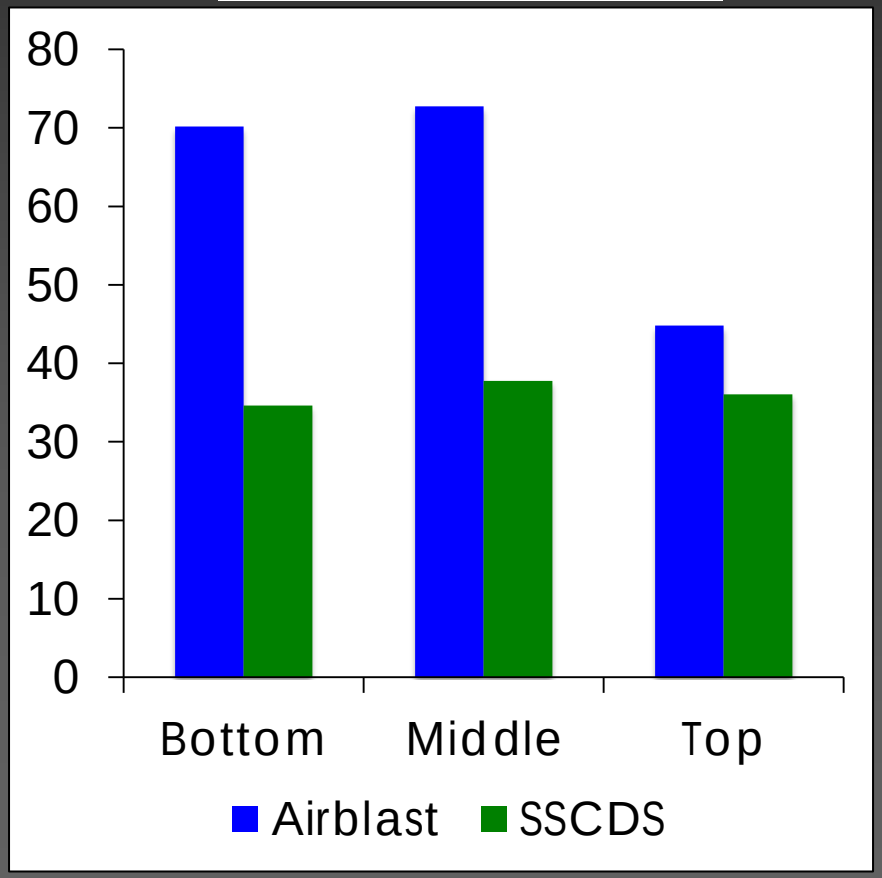
*Washington State Univ Trials (Jay Brunner)*

# % Surface Area Covered

**Upper surface**

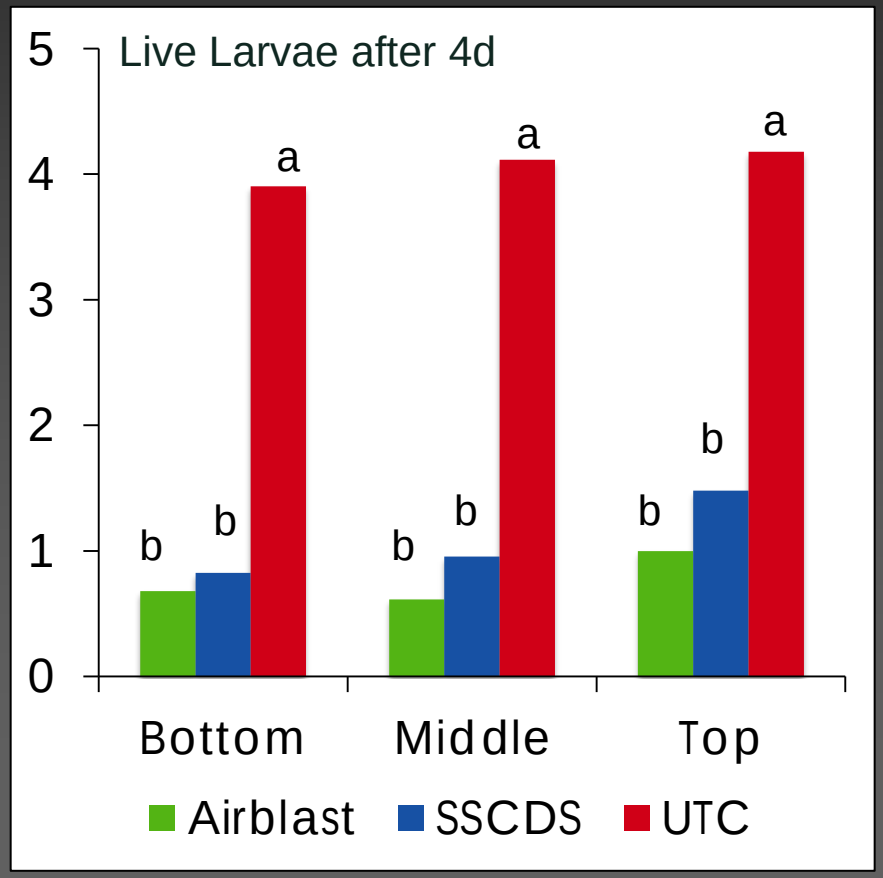



**Lower surface**

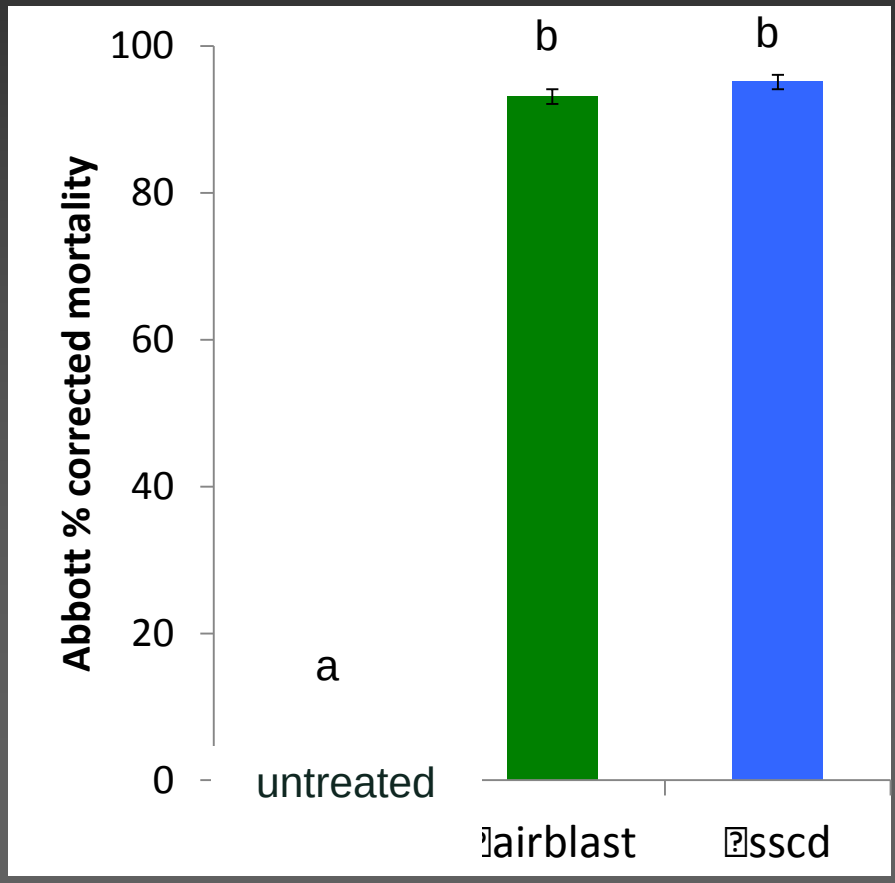


# Leafroller Mortality

## MSU




## WSU



# Progress

- Operational SSCD systems have been developed and tested
- Total amount of material applied to canopy of tree using SSCDS as good as with airblast sprayer
- Coverage on upper leaf surface good – variable on underside
- Efficacy of pest management inputs using SSCDS equivalent to or better than that achieved using airblast sprayer
- SSCDS shows potential for improving efficacy of sprayable pheromone

# Potential Benefits

- Lower labor requirements, equipment upkeep possibly cheaper; potential for a greater degree of automation or precision operation
- Ability to spray in orchard conditions where tractor operation may not be optimal (e.g., early season, low-light hours; highly sloping blocks)
- Short application time:
  - take advantage of narrow application windows
  - multiple sprays and re-sprays much easier; can use short-residual (least-toxic) materials, sprayable pheromones; rescue treatments
- Minimal drift and off-target deposition; quieter operation; less impact on neighbors, adjacent property or roads
- Readily adaptable to use for irrigation, frost protection, sunburn protection

# A Fixed Spray System for Spotted Wing Drosophila Management in High Tunnel Raspberries

J. Moisan-De Serres

# Fixed Spray System for High Tunnels

- Drop tubes spaced every 5 ft
- Rows ~100-120 ft long

- Lines connected to PVC manifold
- Individual gauge and valve for each line

# Fixed Spray System for High Tunnels

- Rears Nifty Pul Tank greenhouse sprayer
- 3 HP motor
- 25 gal tank

- Netafim DAN 7000 series microsprinklers
- 8-mm orifice; flat circular pattern spreader (6 ft diam spray profile)
- 20 psi check valve


# High Tunnel Trial Sites

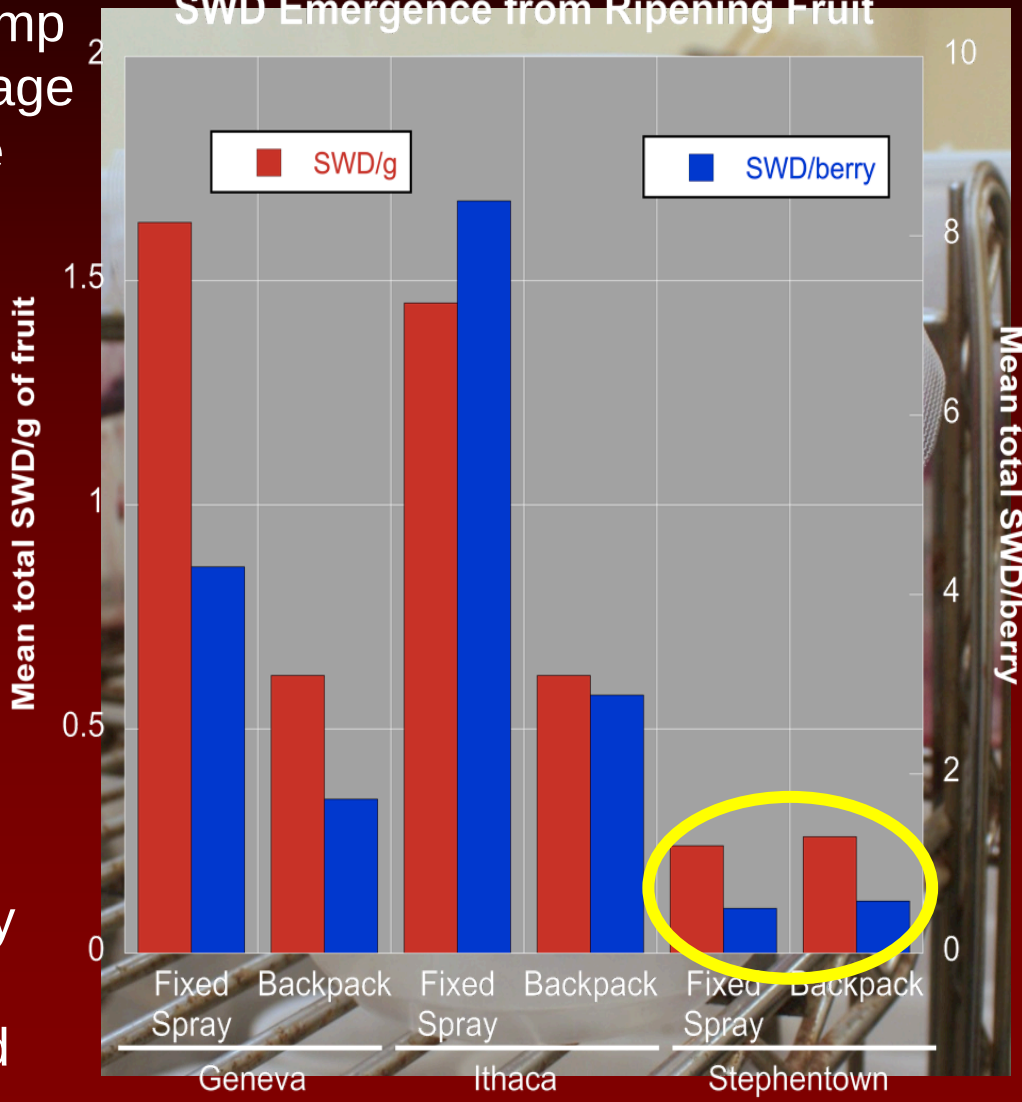
- Research raspberry planting, NYSAES, Geneva
- Research blackberry planting, Cornell, Ithaca
- Commercial raspberry farm, Stephentown
- Sprays applied weekly:
  - 7/29 Delegate 6 oz/A
  - 8/5 Assail 5 oz/A
  - 8/12 Assail 5 oz/A
  - 8/19 Delegate 3.5 oz/A
  - 8/26 Delegate 3.5 oz/A
  - 9/2 Assail 5 oz/A
  - 9/9 Assail 5 oz/A
  - 9/16 Delegate 3.5 oz/A
  - 9/23 Delegate 3 oz/A
- Sugar 2 lb/100 gal added as feeding stimulant to all sprays
- Identical sprays made in check high tunnel plantings using backpack sprayer

# SWD Population & Infestation Assessment

- Early August: Weekly samples taken of maturing fruit, held at room temp to rear out any larvae to adult stage
  - 8-13 samples collected per site
  - 10-20 berries (50-100 g total)
  - both Fixed Spray planting and Check planting sampled

- Stephentown (ripe fruit picked daily): no difference in # of adults from different treatments

- Geneva & Ithaca: ~2.5X as many flies from Fixed Spray as from Check plantings
  - fruit not harvested as frequently
  - blackberry planting much more vigorous; coverage not as good



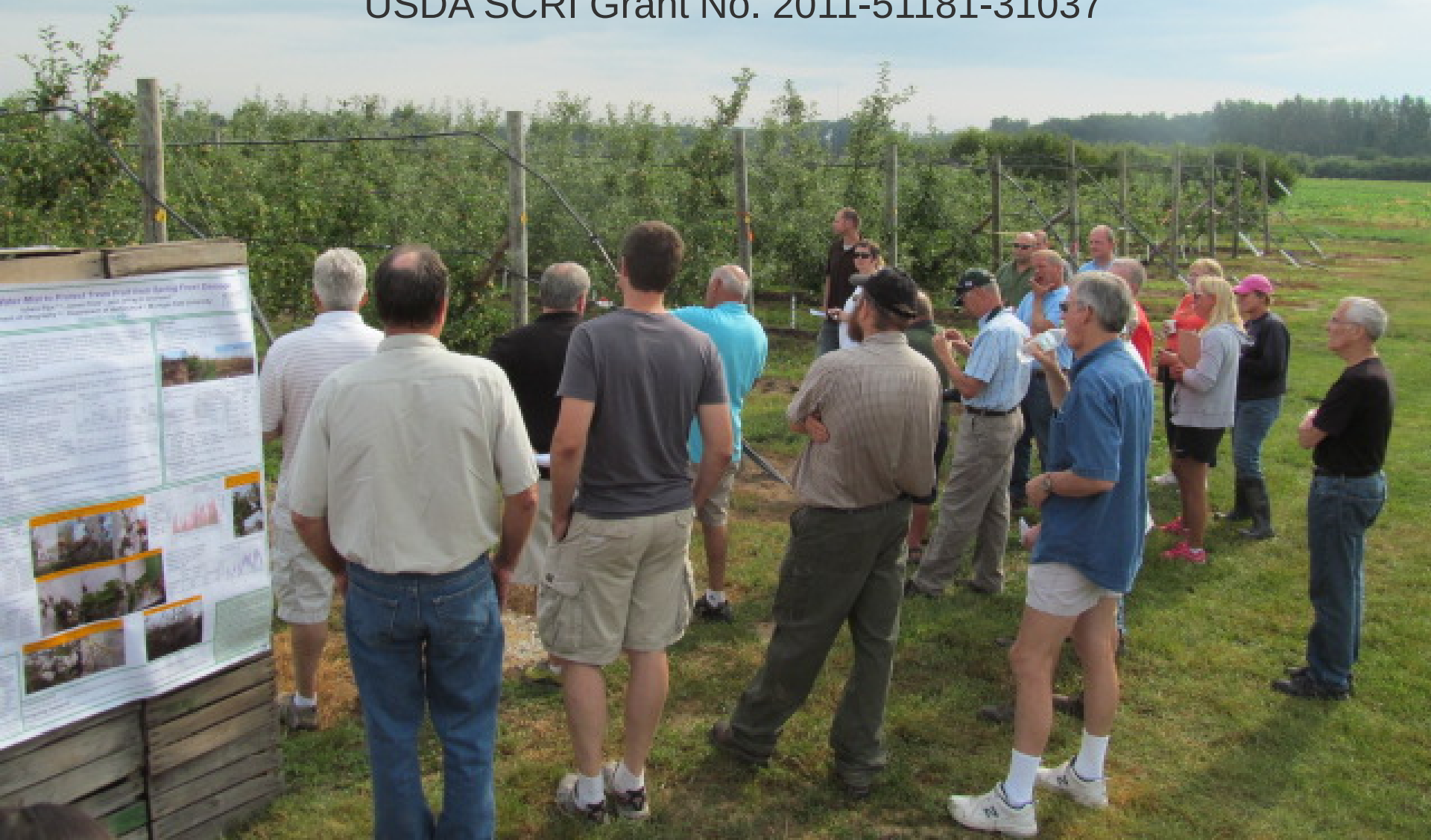
# Future Areas for Possible Improvement

- Shorten spray duration times
  - System could be running too long and washing off active ingredient
- Assess spray coverage on fruit by using fluorescent tracer dye
- Examine possibility of direct pesticide injection (dosing pump) rather than mixing pesticide solutions in the tank
- Quantify pesticide residue levels on the fruit, or conduct bioassays using lab-reared flies to see how efficacy changes over time.
- Look at cultural practices that might increase coverage
  - positioning of canes
  - cane pruning

# Acknowledgments

Team effort: Cornell, MSU, WSU, Private Industry (John Nye, Trickle-Eez Co.), Growers (John & J.D. Fowler, Fowler Farms) and Others

USDA SCRI Grant No. 2011-51181-31037



# Acknowledgments


- Collaborating trial site personnel: Dale Ila Riggs, Laura McDermott, Marvin Pritts, Rich Raba, Courteney Weber
- Technical and engineering assistance: Bill Larzelere, Steve Hesler, Jordi Llorens, Changyuan Zhai, Johanna Elsensohn, Tessa Lessord, Chrissy Dodge, Gabrielle Brind-Amour, McKenzie Schessl, and Allison Wentworth
- Funding support: New York Farm Viability Institute (Dave Grusenmeyer)