Just enough: Ground speed and spray coverage for efficient orchard spraying

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Introduction

Most of the existing research on airblast sprayer use in orchards was done in highly managed canopies (pruned for light interception in fresh fruit production) grown in regions of the US and Europe with more humid, summer conditions compared to the more arid climate of the Central Valley of California. However, a new push to gather data more relevant to CA conditions has begun, supported by the Almond Board of California..

Recent research in almonds has shown that the most effective pest control with airblast sprayers at hull split is achieved with slow sprayer speed (2 MPH) and high spray volumes (100-200 GPA).

What about other timings? Can growers save money and time and reduce drift with different practices at other times of the season?

This study was begun to develop tools and information to help growers do the best spray job possible at different times of the year under conditions of almond production in California in the 21st century. These include:

- Low to no pruning (dense canopies)
- New generation pesticides requiring excellent coverage for best control.
- Increased labor costs.
- High standards for pest control

Figure 1. Study sprayer and orchard.

What We Did…

Two tests were conducted in a commercial orchard in the southern Sacramento Valley in June, 2014.

Spray coverage was measured in the trees at 10' and 20' heights using 1) water sensitive paper cards and 2) non-toxic tracer deposits measured on fibre samplers.

A PTO sprayer (36" fan) – regularly used in this orchard with good results -- was used with a spray volume of 100 gallons per acre (GPA) and an operating pressure of 150 psi (Figure 1). No changes in nozzle number or set up were made during the experiment. Where speed changes required higher spray flow rates to maintain GPA, larger nozzles were used in the same locations with as close to the same distribution of spray flow between the nozzles as possible.

Test 1: The purpose of this study was to confirm spray coverage differences in the upper canopy at high and low speeds using water sensitive paper (WSP) cards. Evaluate differences in coverage from different direction using a four-sided (top, bottom, facing the sprayer row, and facing away from the sprayer row). Water was sprayed down the same side of the tree row at 100 GPA at either:

1.7 MPH OR 3.25 MPH

Percent card coverage at 10' or 20' above the orchard floor and at four directions on each sampler was measured.

Test 2: Can when you spray during the day make a difference in spray deposition – in how much product reaches the target? Using the same sprayer and set up (2 MPH, 100 GPA, 150 psi) we applied four different micro-nutrients at different times of the day across a range of levels of evaporation potential (Figure 2). [Delta (Δ) is a measure of evaporation potential and is determined by the difference between wet and dry bulb temperature (ºC) using a sling psychrometer.]

- 6:30 AM (Δ 0.5)
- 8:30 AM (Δ 6)
- 10:30 AM (Δ 8)
- 1:30 PM (Δ 10)

Spray was applied to three rows on either side of the study row where the samplers were located. Care was taken so that the direction of sprayer travel was opposite for each side of each tree row. Tracers were extracted from the fibers and used to determine how much spray solution was captured at different times, heights above the orchard floor and direction of sampler (top, bottom, east side or west side).

What we've learned, so far:

- Test 1. **We confirmed that speed kills coverage in the tree tops in summer** (see Table 1) and that coverage in the tree tops is less than lower in the canopy. Results also suggested more deposition from spray cloud fall out in the tree tops.
- Test 2. **Spray deposition decreased significantly at Delta values >Δ6, even in the lower portion of the canopy (Table 2).** Differences in deposition between upper and lower canopy were also measured (not new info, but consistent with previous work). Spray fall out was not the major source of coverage in upper canopy. Note the relative differences in spray measurement between upper and lower canopies in Test 1 vs Test 2. These differences are due to at least 2 factors –sampler differences in material [WSP vs cloth] and more complete recovery of spray solution with cloth samplers vs. WSP. Small droplets don't show up on WSP, but are deposited and contribute to pest control.
- More work is planned for 2015 season

Figure 2. Temperature (wet and dry bulb) and evaporation potential (ΔC) on June 19, 2014 – Test 2 spray date. Blue arrows = start times for spraying.

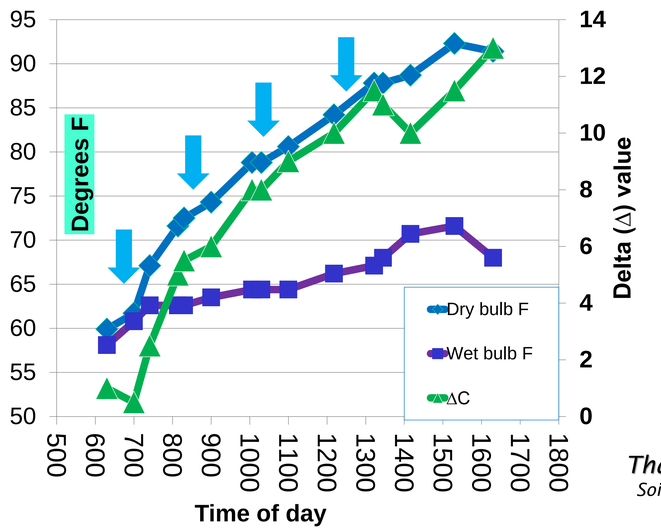

Figure 3. Study samplers. A) Samplers at 10' and 20' used with water sensitive paper or fabric spray collectors. B) Sampler (20') for use in capturing fall out coverage. Detailed images of samplers are inset.

Table 1. Differences in % WSP coverage at 10' and 20' in the canopy at different ground speeds on 6/2/2014. Data from the same column with same letter are not significantly different (95% certainty)

Sprayer speed	10'	20'
1.7 MPH	47.66 a	2.76 a
3.3 MPH	42.29 a	0.21 b

Table 2. Differences in spray deposition per sampler at 10' and 20' in the canopy at different ΔC values on 6/19/2014. Data from the same ΔC timing followed by the same letter are not significantly different (95% certainty)

Height	Delta 0.5	Delta 6	Delta 8	Delta 10
20'	0.02 a	0.03 a	0.02 a	0.01 a
10'	0.08 b	0.09 b	0.05 b	0.06 b

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