Improving Spray Deposition in Upper Canopies of Almond Trees

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Background and Problems

Spray deposition in the upper regions of almond trees is often difficult to obtain when spraying mature or dense canopied orchards. Typical air blast or "speed" sprayers are designed with a single large axial flow fan that is positioned near ground level and often with its center line directly aligned with the towing tractor's PTO shaft. While the low profile allows sprayers to easily transit the orchard, the release of all spray droplets and the air carrier in the lowest regions of the trees results in non-uniform spray deposition in the trees. Attempts to overcome this non-uniform deposition often include applying higher volumes of spray liquid and using slower ground speeds; however this approach results is more time-, fuel- and money-consuming applications.

Objectives of this Work

The objectives of this 2013 project year work were to:

-To deploy an alternative sprayer design in a commercial orchard spraying environment and use it to apply a standard hull split application under commercial conditions, and.

- To investigate an alternative spray application configuration that applied a reduced volume of spray liquid at a higher ground speed for spray deposition and pest control efficacy.

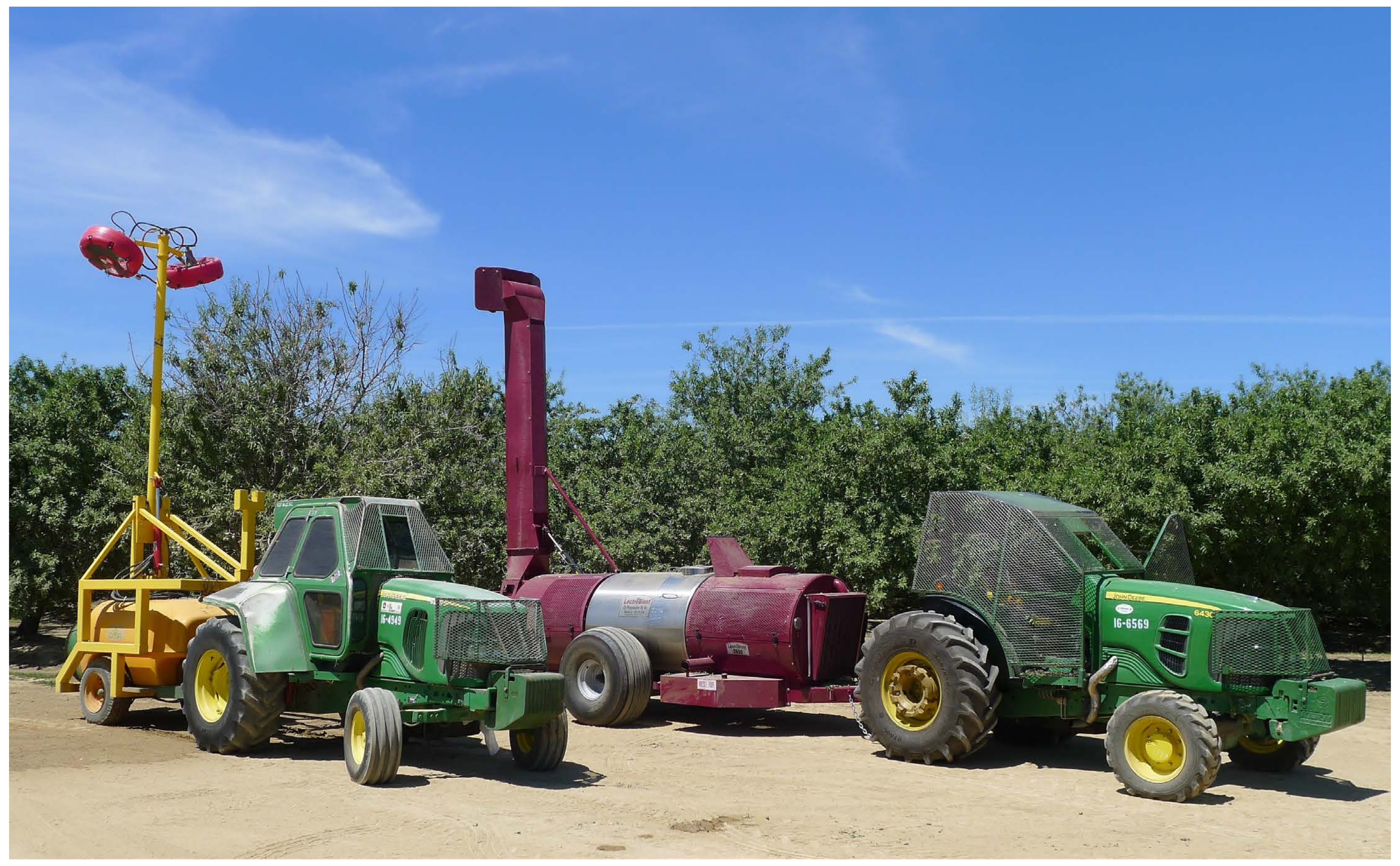
Deploying the Alternative Sprayer Design

A conventional axial flow orchard sprayer (Oma TR1500) was modified by adding two hydraulically-powered axial flow fans (Vinetech,Inc., Pasco, WA, the distributor for SARDI of Australia). The fans were driven by the tractor remote hydraulic system. Each fan had standard disc-core spray nozzles installed radially around the outside the fan housing.

The existing spray plumbing system on the sprayer was retained for the conventional fan nozzles, a parallel plumbing system was added for the upper fans. The pressure could be controlled individually.

The supporting mast for the fans could be lowered by rotation on a mounting shaft at the rear of the sprayer. This rotation was done by a hydraulic cylinder, powered by the tractor hydraulic system.

The Sprayer in a Commercial Orchard



The modified test sprayer (left), along with a tower sprayer, positioned in the commercial orchard for hull-split spray testing. Split (two dates) applications were made. Mechanical durability and compatibility with commercial demands was proven. Pest control efficacy data are pending analysis.

Sprayer Efficiency and Pest Control Testing

Two sprayer machines, applying three different spray application configurations, were tested for spray deposition and pest control efficacy at the Nickels Soil Lab in Arbuckle, CA. Individual "Fritz" trees in a mixed planting (75% Non-pareil, 25% Fritz) were sprayed on the evening of 11 September. The spray solution contained spinetoram (Delegate WG, Dow Agrosciences) at a rate of 7 oz/acre, an elemental molybdenum tracer (Monterey AgResources 5% Liquid Molybdenum) at a rate of 1.5 pts/acre and a surfactant (Wilbur-Ellis Sylgard 309) at a rate of 3 oz/100 gallons water.

On Day 1 and Day 14 after spraying, nuts were sampled from the upper and lower canopy of each treated tree, along with untreated nuts from unsprayed trees in an adjacent block. Nuts were transported to Dr. Joel Siegel's lab in Parlier for Naval Orange Worm analysis of pest control efficacy. Leaf and nut samples were removed from the treated trees and analyzed for tracer deposition. Data analysis is still underway, partially due to the fall temporary shut down of the USDA lab.

Analysis

(i). Sprayer configurations:

The spray applications consisted of:

Treatment 1: 150 gallons/acre with a conventional "speed sprayer"
PTO driven, axial flow 36" fan, 500 gallon tank
1.75 mph, 170 psi liquid pressure

Treatment 2: 50 gal/acre with air shear, high velocity, low volume
PTO driven, 3.3 mph, 30 psi liquid pressure
configured for electrostatic charging but uncharged

Treatment 3: 50 gal/acre with air shear, high velocity, low volume
PTO driven, 3.3 mph, 30 psi liquid pressure
configured for electrostatic charging and charging

(ii). Spray liquid tracer:

Sample	µg Mo/cm^2 ave	µg Mo/cm^2 std dev
T1 upper	0.06	0.02
T1 lower	0.03	0.00
T2 upper	0.06	0.02
T2 lower	0.08	0.01
T3 upper	0.06	0.01
T3 lower	0.08	0.01

The results show very little differences in tracer amounts deposited per unit of leaf area due to the spray treatment.

(iii). Naval Orange Worm control (Analysis underway, results preliminary):

Naval Orange Worm control was evaluated using standard methods by Dr. Joel Siegel at USDA ARS. Concern was noted over the variety used for the experiment (Fritz) due to the hard shell and shell seal preventing NOW neonates from successfully tunneling into the shell. Analysis of the pinned data (NOW eggs pinned onto hulls) found no significant differences in treatments. When eggs were tucked into the suture (testing the most challenging deposition site for the spray deposition), Treatment 1 ("standard spray") was found to produce significantly lower survival of NOW than Treatments 2 or 3. There were no differences in performance of Treatments 2 and 3.