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Improving Sprayer Technology: TIMING, TARGETING and TOWERS

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Our North American tree fruit production system is currently dependent on air-carrier orchard sprayers to apply plant protectants to combat pests. The objective of our MSU research team is to improve orchard spraying technology. That means concurrently to reduce drift, maintain fruit quality and tree vigor, reduce quantity of needed pesticides, increase deposition efficiency and uniformity on the target, and maintain economic viability for the grower. Air carrier sprayers use water and air to carry agricultural chemicals to the target canopy. In an effort to reduce operating cost and loading time many growers have reduced the volume of water in the spray solution. This trend towards "low volume" spraying has tempted growers

to purchase sprayers with too small an air delivery system. The result is inadequate spray coverage, increased pesticide use, loss of fruit quality, and/or higher operating cost. The three primary factors to improve application technology are: Timing, Targeting and Towers.



Timing consists of two components: First, full implementation of Integrated Pest Management (IPM) strategies assure that pesticides are applied only "as needed". It is no longer efficient to apply protectant sprays following the traditional "Spray Calendar". Second, availability of high capacity sprayers to cover the critical production area within a narrow window of concurrent "as needed" and "acceptable weather" conditions (typically 24 to 48 hours). Less pesticides are required to

provide control if they are effectively applied at the optimum time.

Targeting consists of three operations: First, manually close all the nozzles that directed spray either above or below the target canopy. Second, adjust the application rate of each nozzle to match the density of the canopy it targets. Third, install an automated canopy sensing system, "electric eyes," that turns a nozzle or group of nozzles "on" when it senses a target canopy.

Towers sprayers have a radically different air distribution system that produces three significant benefits. First, a conventional air-carrier orchard sprayer directs the air radially out from one central source. Many small droplets are carried through the canopy and released as "drift" in the atmosphere above the trees. An ideal tower sprayer is taller than the target canopy and produces a continuous curtain of "straight stream", uniformly spray laden air. The top of the tower focuses the air slightly downward toward the center of the canopy as well as providing a boundary of clean air above the canopy. This boundary of clean air traps the spray laden air into the target canopy, thus minimizing drift. Second, a tower sprayer moves the spray laden air horizontally, parallel to the ground. The horizontal air movement provides each spray droplet the maximum opportunity to deposit on a target surface before it evaporates or lands on the soil.

Third, a tower sprayer typically produces smaller size spray droplets. Because of the greatly expanded length of the air outlet on a tower sprayer, the manufacturer needs to install many more, smaller nozzles to atomize the spray. Smaller nozzles produce smaller drops which result in improved deposition uniformity. Pest problems start in the areas where it is the most difficult to deposit spray droplets (i.e. back side of leaves and fruit). Careful observation of the target canopy will reveal that big drops tend to deposit on the front side of the first layer of leaves and only small drops land in the hard to reach areas. Spraying smaller drops decrease deposition on the outside edge of the tree where there is excess and increases deposition in the hard to reach areas of the fruit canopy. Some tower sprayers use mechanical rotary atomizers with individual peristaltic metering pumps to minimize nozzle plugging, maximize the number and uniformity of small spray drops, and provide a wide range of continuously variable application rates.

Compact canopies like grapes, blueberries, and dwarf apples enable a grower to use a "tunnel" or "covered" sprayer. Conceptually this is the same as putting two tower sprayers into a portable, three-sided enclosure. The tunnel sprayers tend to be expensive, bulky, and awkward to maneuver in the field. Some units show promise by providing good spray coverage and reducing spray drift. They are particularly effective in minimizing the effect of ambient wind. Catching and recycling the excess spray that drips from the canopy has presented significant problems. Spraying at ultra-low volume and recycling the spray within an air vortex inside the tunnel looks promising.

In conclusion, many growers are spending far too much money on pesticides because they are not investing enough money in a quality sprayer. Improved chemical application equipment when properly integrated with an IPM program produces high quality fruit, reduces pesticide use, reduces spray drift, lowers maximum fruit residues, and returns cash dividends.

Dr. Gary R. Van Ee delivers a 50 min. narrated visual presentation of sixty 35mm slides & 22 min. VHS video covering this topic. You can contact Van Ee at vane@egr.msu.edu or Phone Number 517-353-4508.

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