Modifying weed sprayers for citrus thrips control

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Vertical booms attached to weed sprayers work well for citrus thrips control

Chemical control of citrus thrips is an annual practice in most San Joaquin Valley (SJV) citrus groves, particularly on navel orange plantings. The thrips, *Scirtothrips citri* (Moulton), feed on the rind, causing a ring-scar near the stem end of newly formed fruit. These scars do not affect internal fruit quality, but scarred fruit may be downgraded in the packinghouse. Regardless of appearance, the presence of feeding citrus thrips populations immediately following petal-fall has been shown to cause a decrease in navel orange yield.

The date of citrus petal-fall may vary from one to three weeks in the SJV, commencing in the foothill groves of southern Kern County and ending in valley floor groves in Tulare, Fresno, and Madera counties. Since there are no effective natural controls to protect citrus from this type of injury, pesticide sprays are necessary most years immediately after petal-fall when the fruit starts to form. This timing is also necessary to avoid destroying honey bees foraging on the citrus bloom. Protection must continue for nearly six weeks, until the fruit is approximately 1½ inches in diameter and the rind "hardens-off," when thrips feeding will not cause scarring. Thripsicides need only be applied to the outside surfaces of the tree, because rind feeding and the resultant ring-scarring are confined to the fruit developing on the outer periphery.

Close-up of attachment of vertical boom on conventional horizontal-boom weed sprayer. Bolts and brackets permit easy removal

Citrus thrips are most readily reduced below injurious population levels by pesticides applied in spray droplets with air-blast (air-carried) or boom (water-carried) types of ground equipment. Aircraft applications, although often effective, do not reduce citrus thrips populations as consistently as do ground equipment sprays.

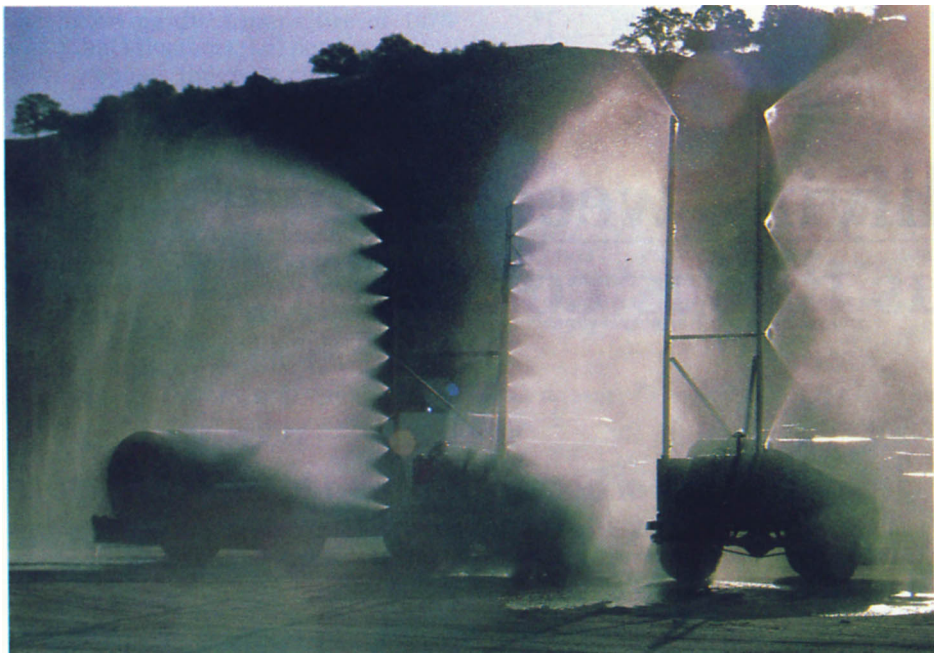
Since spray droplets need not penetrate the tree canopy, applications by air-blast and boom equipment do not require high velocity. However, most commercially manufactured citrus sprayers are designed for thorough coverage to control pests found throughout all aerial parts of the tree. Many sprayers can be adjusted to deliver only minimal pesticide droplets to the inside of the tree by reducing engine revolutions per minute (rpm), reducing pump pressure (psi), increasing nozzle orifice size, or combinations of all three. Increasing ground speed to reduce gallonage application rates should be avoided, because excessive speed (over 2 mph) does not allow adequate coverage on fruit growing between the trees in the direction of travel.

Since the most critical time for protection of citrus fruit from thrips feeding is at petal-fall, growers need assurance that spray equipment is readily available at this time. At present, there are not enough sprayers in the SJV operated by commercial applicators to cover the acreage needing thrips treatment during the short period (one to three weeks) when treatment must begin. Some growers own sprayers but find their specialized use results in high maintenance and application costs per acre, in addition to the initial purchase price.

Most citrus growers own mechanical weed sprayers and use them extensively throughout the year to apply herbicides by both a fixed horizontal boom with downward-spraying nozzles and by hand-guns. A few growers have reported successful citrus thrips control with weed sprayers that they have modified for foliar applications by adding vertical booms. We conducted studies on the effectiveness of thripsicides applied by modified weed sprayers and an air-blast citrus sprayer, as compared with no treatment.

Spraying tests

Three navel orange plantings in Tulare County, two grower-owned and one at the University of California Lindcove Field Station, were sprayed on May 7-8, 1981, with 1 pound active ingredient of formetanate hydrochloride (Carzol) 92 SP per acre. Each grove was divided into six 2-acre plots with two 36-tree (6 x 6) plots left untreated. Lots were replicated twice in each grove and sprayed using a U.C.-owned FMC CP-267 air-blast sprayer, a U.C.-owned and modified Randell weedsprayer, and a modi-



Sprayers tested were, from left, U.C. FMC CP-267, Tyson weed sprayer, and U.C. version.

Citrus thrips feed on rind, causing a ring-scar near the stem end of newly formed fruit (left), a cause for downgrading.

Citrus thrips scarring on treated and untreated navel orange fruit after pesticide applications by three sprayers.*

Sprayer type†	Scarring‡	
	Slight	Severe
	%	%
U.C. weedsprayer	3.0	0.0
Tyson weedsprayer	3.6	0.8
U.C. FMC CP-267	1.8	0.6
Untreated	19.9	69.5

* Formentanate hydrochloride at 1 pound AI/acre applied May 7-8, 1981.
† Gallons per acre: U.C. weedsprayer = 240-250, Tyson weedsprayer = 300-320, U.C. FMC CP-267=200; all at 2 miles/hour.
‡ Average percent scarring from all outside fruit 2 to 6 feet high on outside periphery of 16 trees per plot replicated twice in three groves.

fied Randell weed sprayer borrowed from Ike Tyson, a local citrus grower.

The Tyson weed sprayer is a Randell model R-W-8 equipped with a Lombardini 914 diesel engine and a Hypro 9203 pump (the engine and pump are not standard on this model but were added to give greater gallons-per-minute capabilities). Two detachable 15-foot booms, each with 11 evenly spaced tee-jet nozzles fixed to spray outward at a 90° angle from the direction of travel, were provided by the Randell Manufacturing Company. Hose connections and valves were the same as those used for spraying herbicides.

The U.C. weed sprayer is a Randell model RW-5 equipped with a Wisconsin TJD engine and a Berkeley B1XR pump (both standard with this model). Two 18-foot booms, each with four fixed, evenly spaced, flat-fan nozzles, were made at the Lindcove Field Station metal shop. The blooms were attached with bolts and brackets for easy removal. At a constant pump pressure of 80 psi, the U.C. sprayer delivered 30 gallons per minute (gpm) at 3600 rpm, and the Tyson sprayer delivered 42 gpm at 4200 rpm.

The FMC CP-267 is a low-silhouette, trailer-mounted, air-blast sprayer with seven nozzles per side. Manufacturer recommendations were used for settings to deliver 200 gallons per acre (gpa) at 2 mph with reduced rpm (1200) and psi (120) to minimize spray droplet deposition to the inside of the trees. The 200 gpa at 2 mph has been found to be an effective standard for citrus thrips control. Gallonage for the weed sprayers at 2 mph and 80 psi was established in preliminary trials at 240 to 250 and 300 to 320 gpa for the U.C. and Tyson sprayers, respectively. These gallonages were used in the sprayed plots.

To determine the effectiveness of these sprayers in reducing citrus thrips-induced ring-scars, in October, near harvest time, we counted all of the oranges between 2 and 6 feet high on the outside peripheries of 16 randomly selected trees per plot. Fruit with ring-scars, of the total counted per tree, gave a percentage of scarred fruit from each plot. All fruit with ring-scars were recorded, but nearly invisible scars — those which probably would not downgrade the orange — were separately classified as slight scars. More than 5 percent severe ring-scars, by this method of evaluation, is considered excessive and probably not an acceptable level of control.

With any thripsicide used, effectiveness should not be evaluated sooner than four or five days after spraying, and retreatment should be considered only if second-stage larvae and adults are numerous. Some pesticides are slower acting than others, and overtreatment should be avoided. Adult thrips and first-stage larvae were observed in some of these plots following treatment. The larvae had emerged from eggs after treatment and did not survive and feed; the adults often flew into sprayed plots from surrounding unsprayed trees. Citrus thrips began to infest the sprayed plots in the sixth week after treatment, too late to scar the hardened-off fruit rind.

Results

All three groves had high-density citrus thrips populations in the untreated plots following the May 7-8 treatments. An average of 69.5 percent of the fruit from the two untreated replications in each grove was severely scarred (see table). All of the sprayed plots were virtually free from severely scarred fruit, and less than 4 percent of the treated fruit had slight scars.

In this study, modified weed sprayers were as effective as the conventional air-blast citrus sprayer in reducing citrus thrips-induced ring-scars. Growers who convert their weed sprayers need only to be sure that the pesticide is sufficiently agitated in the tank, that the tank is free of herbicide residues, that the booms are high enough to ensure spray droplet deposition over the entire outside tree canopy, and that the forward speed is slow enough to allow between-tree fruit coverage as the sprayer passes each tree in the row.

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