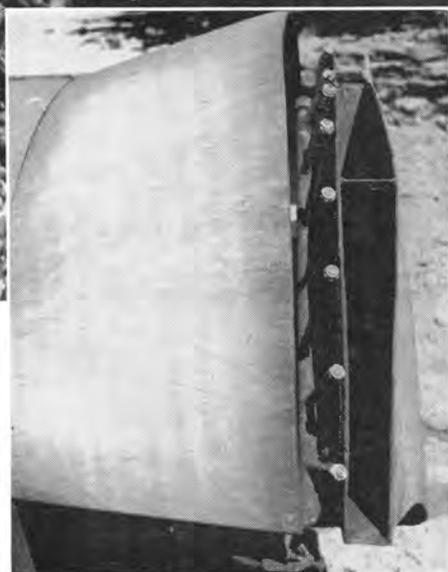


Rear view of concentrate sprayer showing both of the adjustable discharge outlets.



Closeup of spray nozzle and air discharge outlets (inset) of concentrate spray machine.

# CONCENTRATE SPRAYING

*Shown in California Orchard Tests*

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Concentrate sprays gave equal or near equal control against insects and mites on pears, prunes, peaches and almonds when compared with dilute sprays in last season's tests in Northern California orchards. Possible advantages in the use of concentrate sprayers include reductions in the amount of water needed and number of fills now used per acre in dilute spraying (40 to 80 vs. 300 to 1500 gallons per acre). The amount of pesticide used per acre can also be reduced by 25 to 40 per cent. Reductions are also possible in time and man hours per job as well as sprayer costs and maintenance with use of concentrate spraying equipment. No phytotoxic effects were caused by any of the spray test applications.

Concentrate spraying techniques are not new to California farmers; however, recent emphasis on research work with concentrate machines in Canada, Northeastern United States, and Europe has stimulated the development of new machines and spray formulations adapted to this type application. To evaluate the potential for concentrate spraying in California, a machine specifically designed for this work was obtained from a Canadian firm and compared with certain

dilute machines at several orchards for certain specific pest problems. Plots were set up using both machines with specified chemicals for control of given pests in deciduous orchards.

Where the concentrate technique can be used, a considerable saving to the farmer might be realized not only in the reduction of diluting water, which increases the acreage capacity of the machines but also in possible reduction of spray chemical, time and man hours per job and sprayer cost and maintenance. Since concentrate techniques utilize a fine spray application, a reduction in run-off loss of chemical can usually be achieved.

### Definition

The terms "concentrate" and "dilute" are arbitrary designations which loosely indicate the relative quantity of diluting liquid (usually water) which makes up the carrier for a given amount of active chemical pesticide. Although practices vary greatly, dilute spray applications are made at 300 to 1,500 or more gallons per acre (gpa). Strictly concentrate spraying would generally imply very low volumes of 40 to 80 gpa, applied with somewhat smaller air carrier type machines. In general, the machines used for dilute spray-

ing have a greater capacity than the concentrate machines since larger volumes of liquid must be handled. This means dilute sprayers must have larger tanks, nozzles, pumps, engines and fans to obtain the higher air-carrier capacity.

Some dilute air-carrier sprayers could possibly be adapted to concentrate spraying by reducing the number and size of nozzles used—thus reducing the volume of liquid discharged. By proper selection of nozzle types and parts, and in some cases increasing the pump pressure, the atomization or liquid break-up might also be increased to make smaller drops for concentrate work. The extra air-carrier capacity of the dilute machine may not be required when used for concentrate work.

### Sprayer comparisons

The concentrate machines usually have air capacities of 5,000 to 10,000 cubic feet per minute (cfm) for one side; discharge at 120 to 140 miles per hour (mph) air velocity; and use fine atomization type nozzles with liquid pressures of 100 pounds per square inch (psi) or more. The dilute and semi-concentrate machines have air volume variations from a minimum of 15,000 cfm per side up to 40,000 cfm or more. The air velocity may be

somewhat lower at around 100 miles per hour. The nozzles are coarse atomizing, and the pump pressures are seldom over 100 psi on the dilute machines.

The concentrate machine used in these 1961 tests was a two-sided-discharge unit of approximately 7,500 cfm per side, and 120 mph velocity. Seven tungsten carbide nozzles and swirl plates are used per side, applying about 60 gpa when traveling at 1½ mph. The spray pump is a centrifugal design operating at around 100 psi. The spray tank is made of stainless steel and has a capacity of 350 gallons. Nozzles of hard material are also used to reduce

and TEPP, Tedion, and Chlorobenzilate were applied for mite control. Lime sulfur and copper were used for scab and blight respectively. Although the different materials varied in their degree of control, equivalent results were obtained with the concentrate and dilute applications against the potato aphid, European red mite, and codling moth.

Mealybug control was not as good in the concentrate plots as in the dilute sprayed plots. Fruit russeting counts showed 3 to 11 percent less russeting in the concentrate plots as compared to the dilute. A postharvest European red mite trial with DN-111 showed comparable control with both sprayers. There were no phytotoxic effects noted with any of the applications.

### Prunes

These tests were run primarily on the Smith Ranch, Gridley, Butte County. The concentrate machine was used at 60 gpa except for one 30 gpa application. The dilute machine, which had an air volume and velocity similar to the pear tests, applied 350 to 375 gpa. Equivalent control was found with applications made by both spraying methods on leaf curl plum aphid and two-spotted mite.

A number of oil and oil-phosphate combinations were compared at the delayed dormant and pre-popcorn periods for control of the peach twig borer and the San Jose scale. No differences were apparent in control of the peach twig borer, but results were variable against the San Jose scale. At the delayed dormant period, the dilute sprays provided better control than the concentrate. At the pre-popcorn stage,

there were no differences between methods of application. In both spray periods, parathion and oil provided the best control.

### Peaches

Trials on Vivian variety peaches were carried out at the Blaser Ranch near Yuba City. The concentrate machine applied 60 to 80 gpa while the dilute machine was set for 400 gpa with air volume and velocity similar to that used on pears. Peach twig borer counts were made on shoots seven weeks after a March application of parathion, Sevin, Guthion, and DDT. All materials except DDT gave excellent control with both the concentrate and dilute machines. Another twig borer spray was applied in June to some of these plots. At harvest, all treatments showed good control except the DDT plot and the plot with a single June application of parathion. Trees receiving both March and June applications showed better control with either sprayer than did those receiving only a single March or June treatment.

San Jose scale on peaches was controlled equally well by both concentrate and dilute applications. There appeared to be no difference between the single and double treatments for scale control.

Peach silver mite populations were evaluated in plots receiving different sprays and differently timed applications. Sulfur was included with both the March and June applications of parathion, Sevin, Guthion, and DDT, but was used alone in July. The March and July applications gave poor control. June appeared to be the most critical period for control of silver mite. Plots that included a spray

## POSSIBILITIES

the abrasion and corrosion wear from the concentrate spray materials. A 56 hp Wisconsin air-cooled engine drives an axial flow fan to supply the air-carrier flow.

The dilute sprayers used in the comparison tests are further identified in the following plot discussion. The test work was carried out in Butte, Sutter, and Yuba counties. Each application was duplicated with the concentrate and dilute sprayer. Concentrate applications were applied with 85 to 95 per cent less water per acre and from 25 to 70 per cent less active chemical per acre.

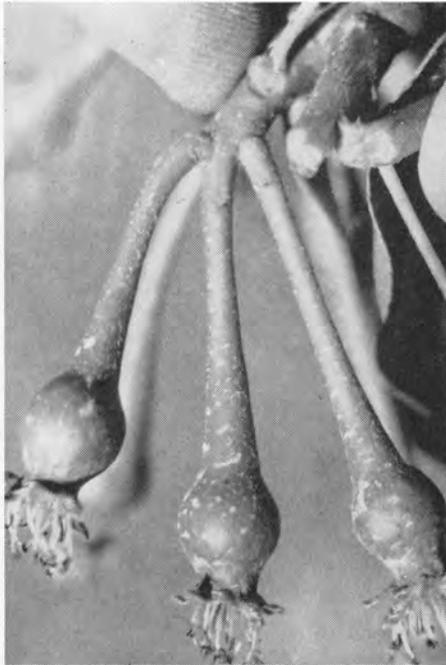
### Pears

Tests were conducted on mature Bartlett trees at the Di Giorgio orchards, Marysville, Yuba County. The concentrate sprayer applications were made at 60 gpa and 1½ mph. The dilute machine used for comparison, applied spray at 750 to 1,300 gpa traveling at about 3 mph. Total air volume was about 55,000 cfm (two sides) at 90 mph.

Chemical applications were made for control of codling moth, European red mite, mealybug, aphid, scab, and blight. The first application was made in the dormant period; and codling moth, mite and disease sprays were applied as the season progressed. Guthion, Sevin and DDT were used for codling moth control

Low volume concentrate machine, clearly visible below to left, contrasts with almost hidden dilute sprayer to right.





Even deposit and smaller droplet size of spray material seen on immature pear fruit, left, resulted from application with concentrate spray equipment. Spray pattern resulting from use of dilute spray machine is seen in photo, right.

at this time provided the best mite reduction with either method of application.

Brown rot counts were made at harvest although the disease incidence was not high. Equal control was obtained with either sprayer following applications including three sulfur treatments, two sulfur and one captan, or one June sulfur plus a pre-harvest captan spray.

#### Almonds

Only one concentrate and dilute control test was run on almonds. A Trithion spray for brown almond mite gave very good control with both sprayers. The concentrate application was at 60 gpa and the dilute at 400 gpa. The dilute rig was similar to those used for the other tests.

#### Residue data

The amount of spray residue found on leaves and fruit was utilized as a method of comparing concentrate with dilute spraying. Samples consisted of leaf sections, taken with a leaf punch, and fruit located 5 to 6 feet and 12 to 15 feet above the ground and alternately from the inside and outside of the tree. The insecticide spray deposit was analyzed by means of a gas chromatograph and the zinc oxide pattern sprays were determined by X-ray technique. In general, the residue data showed less deposit with the concentrate spray applications. However, in most cases these deposits were proportionate to the lesser amount of chemical applied per acre (25 to 70 percent) with the concen-

trate machine. Leaf residue data were more consistent than fruit data. On pears, the concentrate spray plots showed less deposit in the tree tops as the season progressed. Residue deposits varied with the insecticide applied.

Zinc oxide data also showed inconsistencies, especially in the tops of the trees. This material gives a white deposit which enabled spray pattern and coverage studies at any place in the sprayed tree. Safranine dye sprays gave the same effect when waxed cards or paper were placed in the tree at various locations. Both the zinc oxide and red dye sprays clearly showed the difference between the patterns of the concentrate and dilute spray deposits. The finely stippled deposit of the concentrate spray could be readily distinguished from the wash or blotchy type deposit of the dilute spray pattern.

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Many of the tests and experiments conducted in laboratories, greenhouses and campus test plots show promise of improving crop or animal production. But the final determination of whether to go ahead with a new variety, breed or management technique may depend on field scale commercial testing. Hundreds of California farmers and stockmen cooperate each year in this field testing program under the direction of Experiment Station and Extension Service researchers. Their generous contributions of land, water, seed, plants and animals for this purpose are rewarded only by the satisfaction of knowing they have contributed to the improvement of agricultural production—and the general welfare of mankind.

## FARM COOPE



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In the field trial shown, Thompson Seedless grapes were grown on four different rootstocks—their own, Salt Creek, Dogridge, and 1613. This was a replant situation in soil heavily infested with root-knot nematodes. The vines grown on their own rootstocks failed completely; those on Dogridge had the most growth, followed by Salt Creek and 1613. Those on Salt Creek and Dogridge produced about the same yield—considerably better than those on 1613, which made very little growth (row on right in photo). The test was conducted at the Robert Brose vineyard, Fresno County, under the supervision of Curtis D. Lynn, Farm Advisor.