

# Concentrate Sprays

## as applied to deciduous fruit trees

Arthur D. Borden

INTRODUCTION OF THE AIR-CARRIER type of sprayer in 1944, demonstrated the value of a large volume of air at low velocity in obtaining an even, uniform insecticide coverage in deciduous fruit orchards.

This equipment would eliminate 80% of the labor cost when compared to the conventional ground portable equipment, but there remained the problem of hauling large volumes of water to keep the spray tank filled.

The so-called concentrate sprays had been employed in vapo-duster and other equipment. The formulation of such concentrates was usually on a 50-50 dilution and the gallonage per tree was reduced, so as to give an equivalent amount of the active ingredient per acre as was used in

solvent and an emulsifier. This concentrate contained approximately 36% DDT and was used at various gallonages in a 500 gallon tank of an air-carrier type sprayer.

It was applied in a codling moth control program as a partial concentrate on 30 acres of large Bartlett pear trees which in the previous season, following five applications of standard lead arsenate, had shown over 20% wormy fruit.

Three gallons of the DDT concentrate were added to each 500 gallons of water applied. The discharge of the equipment was reduced by plugging out every other nozzle in the spray head and reducing the disk openings of the nozzles from 0.096 to 0.050 inch. The discharge per tree at a

At harvest, following three applications—calyx and two covers—spaced 16 days apart, not a single wormy fruit was found in this orchard. No injury occurred to fruit or foliage, and a clean crop of fruit was harvested.

The economy in this type of application was shown not only in the fact that about 250 trees were sprayed per 500 gallon tank, as against 20 to 25 trees in bulk spraying with the same spray equipment, but the cost of spray materials used per acre was only \$2.03 as compared with \$16.83 per acre with bulk spraying. One tender wagon could conveniently service several pieces of equipment, as it took over an hour to empty each tank. The saving in cost of material and labor and the efficiency of this method make it most promising.

### Dormant Oil Sprays

Three types of oil emulsions are in use as dormant oil sprays. The flowable emulsion containing 83% oil; the emulsive oil containing 98% to 99% oil; and tank-mix spray oils 100% oil. The oils used in these sprays are all of the same general specifications: Unsulphonated residue 70% to 73%; viscosity 100-120 sec. Sayboldt; class, heavy. The type of emulsifier used determines the deposit and compatibility of these emulsions. In general the emulsive oils and tank-mix oils have always given higher deposits.

Applications were made of all three types of these oil sprays employing two air-carrier type of sprayers of identical construction. One piece of equipment used for the application of bulk type sprays was equipped with 82 nozzles with 0.096-inch disk openings and the other used in the partial concentrate sprays had 36 nozzles with 0.062-inch disk openings.

The speed of the bulk spray applications was about 1.5 miles per hour or 132 feet per minute. The bulk sprays were applied at the rate of nine gallons per tree. In applying the partial concentrates, the speed of the equipment was adjusted so as to come as near as possible to the point of no run-off and averaged 1.4 mile per hour. This gave an average of 55 trees per 500 gallon tank in the bulk spraying and 200 trees per 500 gallon tank with the partial concentrates.

After the sprays had dried, five twigs from the past season's new growth were selected from both a low—four to six feet—level and a high—14 to 16 feet—level from six trees in each spray plot. These samples were washed with a solvent in the field and the wash and twigs were brought into the laboratory for analyses and area measurement. As shown in Table 2, the bulk sprays of the emulsive oil and the tank-mix oil deposited nearly one-and-one-half times as much oil as did the oil

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TABLE 1

Amount of Oil Deposited on Bark of Pear Twigs

Applied as	Type of oil used	Gallons per 100	Actual oil applied per tree	Number trees sprayed per 100 gallons	Milligrams oil deposited per square inch	
					Low	High
Bulk spray	83 per cent oil emulsion	5	.373	11	2.83	3.10
Bulk spray	99 per cent emulsive oil	4	.356	11	4.11	4.20
Bulk spray	100 per cent tank mix	4	.36	11	4.20	4.37
Partial concentrate	83 per cent oil emulsion	8	.166	40	3.10	3.56
Partial concentrate	99 per cent emulsive oil	6.5	.160	40	4.39	4.57
Partial concentrate	100 per cent tank-mix oil*	6.5	.160	40	4.47	5.03

\* Plus 4 ounces blood albumin spreader per 100 gallons of water.

the conventional bulk sprays. Without adequate air volume and directional control of the discharge, the coverage was not always satisfactory with such small volumes.

### Foliage Sprays

In the spray season of 1946 a concentrate DDT emulsion was made by properly combining technical DDT, a suitable

speed of 1.1 miles per hour amounted to about two gallons per tree. There was practically no run-off or drip of the spray solution either from the fruit or from the foliage.

Chemical analysis of the deposits on the fruit, before and after each spray application and at harvest, showed as good or better deposits than were obtained with conventional bulk sprays applied with the same type sprayer.

TABLE 2

Per Acre Cost of the Materials of Dormant Oil Spray Applications on Pears Planted 90 trees per Acre

Type of oil used	Price per gallon	Bulk sprays		Partial concentrate	
		Gals./100	Cost	Gals./100	Cost
Flowable oil emulsion	\$.18	5	\$ 7.29	8	\$ 3.24
Emulsive oil	.18	4	5.83	6.5	2.63
Tank mix oil	.14	4	4.53	6.5	2.05

## TEMPERATURE

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tissues, such as a continuous expeeler press, vibrating screens or the like.

The must from the present crusher and stemmer would be pumped through the heat interchanger which contains both a heater section and a cooler section, in series.

In order to insure a constant or controllable flow, a surge tank might be required ahead of the heat exchanger.

The heated and cooled must would pass immediately through an appropriate juice extractor and from this unit, the juice would be pumped into closed fermenters designed for operation at constant temperature of 70° F or less—automatically controlled.

It is known from studies by many investigators that heat does not cause any injury to the juice.

The momentary application of heat under the modernized system would have little effect on flavor.

The exact temperature and time relationships for obtaining the most desirable results with all varieties would require considerable work. The variations in composition—color, tannin, acid, flavoring constituents—would permit a variety of products to be made from the same grape variety.

Heat accomplishes other and perhaps far-reaching, effects. A very considerable reduction, if not complete destruction, of the microbial load would occur. Both the beneficial and the harmful organism are reduced in numbers. A pure yeast strain, or mixture of strains, would be required as a starter. This can only be considered as a desirable accomplishment.

It might be found that the reduction in bacterial load would eliminate the present necessity for using sulfur dioxide, or at least, markedly lessen the amount required. This, too, must be considered as a desirable accomplishment.

### Advantages

Other advantages warrant mentioning. There is a higher yield of juice per ton of fresh grapes crushed. The greater fermentation efficiency would give the recommended system a greater over-all winery efficiency than the system now used.

Residual sugar in the pomace would be removed more easily by leaching and pressing operations. These could be established as an integral part of the juice extraction units and the pomace need never accumulate in or around the winery.

The extracted juice can be balanced or adjusted more easily to a uniform composition prior to fermentation.

The production of wines of better qual-

ity with greater efficiency would more than offset the capital expenditure for the additional equipment and greater refrigeration requirements.

Finally, the possibility of producing distinctive wine types is almost unlimited.

The recommended system modernizes wine-growing and permits much close control of the principal step in the conversion of grapes to wine.

*George L. Marsh is Assistant Professor of Food Technology, and Assistant Chemist in the Experiment Station, Berkeley.*

## SPRAYS

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emulsion even though the actual amount of oil applied per tree was approximately the same.

In the partial concentrate spray applications, the oil deposits were slightly better than the bulk sprays throughout, and the emulsive oil and the tank-mix oil deposits were 1.4 times the deposits of the oil emulsion.

Per tree, the deposits of the partial concentrate sprays were higher than the deposits of the bulk sprays, even when less than half the amount of actual oil was applied.

Table 2 shows that a saving of 55% in the cost of material per acre is possible with the partial concentrate sprays.

Though the equipment used in this experiment was of a type producing over



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50,000 cubic feet of air per minute and had further been perfected as to directional control of the discharge, other equipment of less volume undoubtedly could be used in orchards where the trees are not as large. A large volume of air is essential, especially in foliage sprays and many types of equipment lack this essential.

*Arthur D. Borden is Associate Entomologist in the Experiment Station, Berkeley.*

*Harold Madson, Research Assistant, Division of Entomology assisted in the investigation reported here.*

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