Citrus Pest Control

studies made of results from the addition of 2,4-D to oil sprays

W. S. Stewart and L. A. Riehl

Adding 2,4-D to oil sprays has reduced fruit-drop, mature leaf-drop, fruit-stem die-back and black-button formation during citrus fruit storage.

The drop of immature, green navel oranges that sometimes occurs in the fall was reduced as well as the subsequent preharvest drop of mature fruit that occurs in the spring. The 2,4-D in oil applied in September was still effective in reducing fruit-drop the following March. The 2,4-D not only reduced drop of sound fruit but also of frozen, water spot and other cull fruit.

The addition of 2,4-D to oil reduced fruit-stem die-back but adequate data are not yet available to determine whether or not a similar effect may occur in the case of leaf-stem die-back.

Preliminary data have indicated a reduction in split fruit of Valencia oranges. No information is on hand, however, for other citrus varieties.

Various Forms of 2,4-D

Pure 2,4-D is an organic acid which is only slightly soluble in water. To make 2,4-D soluble in water it is usually prepared as a salt. The ammonium and sodium salt of 2,4-D are solids—powder—while the organic alkanolamine salts—for example, diethanolamine, triethanolamine—are liquids.

In addition to water-soluble forms of 2,4-D, oil-soluble types also are available. These are known as esters and are in liquids. Experimental observations to date indicate that for use in combination with oil sprays, the esters are the most efficient form of 2,4-D. In tests comparing various esters no advantages of one kind over another have been apparent. Proprietary spray oil formulations in which the ester form of 2,4-D has already been dissolved in the oil will probably be available soon, in which case the manufacturer's directions for the use of these products should be followed carefully.

Concentrations of 2,4-D

The amount of 2,4-D added to the spray may be expressed either on the basis of the total volume of the finished spray mixture or of the oil. If an ester is used it is suggested that the concentration should be 250 p.p.m.—parts per million—of the free acid equivalent of 2,4-D in terms of the oil or four p.p.m. in terms of the total volume of spray. This is as effective as eight p.p.m. of a salt form of 2,4-D.

The type of oil spray mixture should govern the type of 2,4-D used. Emulsive and flowable emulsion are the types of oil spray mixtures commonly used. A third type, tank-mix, is used sometimes.

Important features of these mixtures are:

1. Emulsive—sometimes referred to as Soluble. Oil-soluble emulsifying agents have been added to the oil. This prepared oil is put in the tank with a small amount of water and emulsified by means of the pump and agitation in the tank, then water is added to fill the tank.
2. Tank-mix. The emulsifying agent—ordinarily blood albumin—is first added as a separate item to the water in the spray tank. Then the oil is put in and emulsified by means of the pump and agitation in the tank.
3. Flowable emulsion. The formulation itself is a concentrated emulsion. The spray mixture is prepared by extending this emulsion with water during agitation in the tank.

In all types it is preferable to have the oil-soluble ester form of 2,4-D incorporated in the oil itself. With emulsive and tank-mix spray oils this may be done by direct addition of the undiluted ester or if the pure ester is not available, a commercial weed-killer preparation containing the ester in diluted form may be used. It is very important to insure uniform distribution of the ester in the oil. Dissolving the pure 2,4-D ester in the oil before it is made into a flowable emulsion is the preferred means of introducing 2,4-D into the oil phase of flowable emulsions.

Addition of a commercial ester weed-killer to a flowable emulsion in the spray tank appears inadvisable because these 2,4-D preparations usually contain emulsifying agents which may interfere with the oil emulsion. For these reasons if it is necessary to add 2,4-D to flowable emulsion oil sprays in field operations the water-soluble organic salt form of 2,4-D should be used. It should be added to the spray tank at 8 p.p.m. on the basis of total spray volume.

When a pure ester of 2,4-D is added directly to the oil itself, a concentration of 250 p.p.m. in terms of the oil is an effective dosage. Oil containing this concentration of 2,4-D when used in conventional amounts is diluted to the equivalent of about 4 p.p.m. 2,4-D in the final spray mixture.

A number of 2,4-D ester preparations are now on the market as weed-killers. The amounts of some of these materials required to give a concentration of 250 p.p.m. on the basis of the total volume of spray are given in the table below.

An oil spray containing 2,4-D should be applied in the usual manner, that is, as a full coverage, drenching spray. Field studies have indicated that the amount of

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Amounts of some proprietary 2,4-D weed-killer formulations for approximately four p.p.m. 2,4-D equivalent in the finished oil spray mixture. This data furnished as a convenience to the grower and no recommendation of one preparation over another is intended.

Preparation	Per cent 2,4-D equivalent	Add per gallon of oil for approximately 250 p.p.m. in the oil: Cubic centimeters or milliliters
Esteron 44	37	2.14
Dupont 46% ester 2,4-D weed killer	39	2.09
Weed-no-more	32	2.63

Preparation	Per cent 2,4-D equivalent	Add per 500 gallons of finished oil spray mixture for approximately 4 p.p.m.		
		Fluid ounces	Standard measuring spoons	Cubic centimeters or milliliters (One gal. contains 3,785 cubic centimeters)
Esteron 44	37	5/8	1 tablespoon plus 1½ teaspoons	19.2
Dupont 46% ester 2,4-D weed killer	39	5/8	1 tablespoon plus 1½ teaspoons	18.9
Weed-no-more	32	3/4	1 tablespoon plus 2 teaspoons	23.7

2,4-D

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oil deposited was not influenced by the presence of 2,4-D.

Time of Application

Application of 2,4-D should be avoided from one month before bloom to one month after bloom and, of course, oil sprays usually are not applied during this period. When spraying lemons this caution may not be so important. In any case the established practices under local conditions with respect to timing, grade of oil, dosage, temperature, etc., should be followed, unless applications coincide with the bloom period.

Application of 2,4-D in oil even at the low concentration of four p.p.m. in the finished oil spray mixture may cause leaf curling when applied on young, actively growing shoots. Data thus far obtained indicate no decrease in fruit quality or production as a result of the curl. The leaf curl may be minimized by spraying with 2,4-D between leaf growth flushes.

The vigorous, rapidly growing whips or sucker-shoots of lemons are very sensitive to 2,4-D and may be killed at the tip by its application. Subsequent to the killing, however, these suckers have been observed to produce short lateral fruiting branches.

In orchard practice the tips of these suckers are often mechanically cut off to accomplish this same purpose.

There is no information available on the effect of two applications of 2,4-D per year. It is not anticipated difficulties would arise in this regard provided the bloom period were avoided.

Spray rigs previously used for 2,4-D weed spraying should be thoroughly cleaned before applying oil sprays on citrus. Flush the tank several times with a strong alkaline water solution—soda ash, etc.—and rinse with clean water. If the rig was previously used with weed-oil, and 2,4-D, rinse out the oil residue with kerosene or some similar petroleum solvent before using the alkali solution.

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AVOCADO

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Virtually every horticultural practice has been tried to correct the alternate bearing behavior of the Fuerte avocado variety. Among these are orchard fertilization, fruit-thinning and pruning.

Of all the practices tried, only one worked, but unfortunately it is not applicable to commercial practices.

That was very early harvesting—as soon as the fruit attains horticultural maturity—coupled with girdling. When these were done it was possible on individual limbs to produce two good crops in succession and to change the stride of alternation so that limbs on the same tree were in opposite stride.

Early harvesting without girdling did not accomplish the desired result.

The conclusion has been reached that there are really only two solutions to the problem of alternate bearing in the avocado.

One of them is finding strains or seedlings of Fuerte that are less subject to the factors that cause alternate bearing. Evidence exists that there are at least two strains and one that is somewhat better than the other has been isolated. The better strain seems to be less sensitive to unfavorable temperatures during the fruit-setting period, and its alternation is more regular and perhaps not quite so wide in amplitude as that of the other strain.

The other solution—upon which work was started several years ago—is the breeding of varieties that have the desirable market and other qualities of Fuerte but are less subject to the alternate bearing habit.

There is some hope in the picture because there are some varieties that don't alternate much. Perhaps by using them as parents in a breeding program their desirable characters in this respect can be converted to their progeny, and at the same time the desirable characters of Fuerte can be brought into the progeny. If so, the resulting product will be better than anything produced now.

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RATS

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only by a trained official. All of the gases used are poisonous to man and domestic animals.

Calcium cyanide is the commonest material used in gassing. It is available both in granular form and as a dust. The dust is applied with a special pump and a hose for insertion inside the burrow. Granular cyanide is applied directly inside the burrow.

Other gases which are effective include carbon disulfide, sulfur dioxide, and methyl bromide.

A simply administered gas is carbon monoxide from an automobile exhaust which can be forced through a hose into rat burrows. This gas may be used for burrows under cement farm buildings where cyanide would be dangerous to livestock.

Poisonous dusts are effective in some cases. ANTU—up to 20%—when mixed in flour, pyrophyllite, or talc, may be dusted heavily on rat runs and entrances to burrows for control of Norway rats.

In areas where murine typhus is a hazard, DDT dust—5% to 10%—is placed on runways to catch on the feet and fur of passing rats and kill many of their fleas. Any of these dusts can be applied with a sifter can.

When rat burrows are numerous in fields, the burrows may be destroyed by plowing to a depth of 18 inches with a subsoiler or chisel.

Rats may sometimes be killed by flooding their burrows, especially on poultry farms.

Since fleas and mites will leave dead rats and may get onto people, the trapper should handle dead rats as little as possible and should wear gloves.

Dead rats and mice should be burned out-of-doors, or buried at a depth of not less than two feet.

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SULFA

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moving the bacteria which were harbored in the organs of the birds.

Data concerning the effect of the sulfa drugs upon reactors and carriers indicate that the present drugs cannot be relied upon to remove carriers of organisms which cause fowl chlorea, pullorum and typhoid disease of poultry. At best the drugs may be used in acute outbreaks in the hope of salvaging as many birds as possible. It is strongly recommended, however, that the salvaged birds not be used as breeders.

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