Isopropyl Available for Citrus

registration of the isopropyl ester specifically for use as plant growth regulator on citrus permits this form of 2,4-D

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The value of 2,4-D and related substances for preventing mature citrus fruit drop, for increasing fruit size, and for amending oil spray used for pest control to prevent leaf drop or fruit drop—or both—has been demonstrated.

Sodium and ammonium salts, various alkanolamine salts, and isopropyl and butyl esters of 2,4-D have been satisfactory but the isopropyl ester was generally chosen for citrus.

The volatility of the isopropyl and butyl esters is relatively high and appreciable amounts of the vapors of these materials may be carried in warm air. For this reason, unfavorable effects on highly sensitive crops—cotton, tomatoes, grapes, and others—occurred frequently when relatively high volatile esters such as isopropyl were used for weed control. Esters with higher molecular weight and lower volatility have been developed which are quite effective as herbicides. Hence, herbicidal use of the highly volatile esters is not generally permitted.

Observations during the 1955 season indicated that in several instances injury to young citrus trees and damage to the crop of mature trees occurred when low volatile esters of 2,4-D were added to sprays applied to the orchard. No such injury was noted for the isopropyl ester in 1955 or previous seasons when it was used correctly.

For this reason the isopropyl esters of 2,4-D and 2,4,5-T—for use as plant growth regulators on citrus only—are again available. Formulations of the isopropyl and other esters with high volatility are accepted for registration as plant growth regulators in California under the Auxiliary Plant Chemical label.

The volumes of the isopropyl ester of 2,4-D now permitted for a specific purpose are shown in the upper table in the next column. Fruit sizing spray concentrations are given in the lower table. No concentration in excess of 24 ppm—parts per million—of the isopropyl ester of 2,4-D should be used for growth regulation purposes, and even small quantities of growth regulator require exact measurement and careful addition to the spray mixture.

No advantages have been found from the application of 2,4-D to young citrus trees; rather observations have indicated that development may be retarded both for young trees and older ones recently hedged or severely pruned. For these reasons, application of 2,4-D to such trees should be avoided. Furthermore, 2,4-D applied near a growth flush will cause leaf curl.

Injury from 2,4-D to trees less than six years old has been noted occasionally since 1946 in both young orchards and replants. Usually, such injury was attributed to carelessness in the application of 2,4-D for weed control purposes in citrus orchards. Deleterious effects of 2,4-D—other than those to young trees—such as severe leaf curl, excessive roughness of the fruit rind and, in exceptional cases, thinning of the crop, have occurred in orchards throughout southern California from time to time during the past eight years. Generally, these effects occurred as a result of contamination in spray tanks through use of the rigs for weed control or from mistakes resulting in excessive concentrations of 2,4-D.

During the 1955 season, low volatile esters formulated for weed-killing purposes were applied to citrus extensively for growth regulating purposes as a substitute for the isopropyl ester.

Damage from sprays containing low volatile 2,4-D—applied to citrus during the summer and fall of 1955—was observed by other research workers. In brief, damage to the bark of the trunk at the soil line resulted in girdling. The trunk injuries resembled brown rot gummosis, but the lesions were not typical of that disease in that the dead bark was soft and cheesy in texture and tan in color. Many young trees were killed outright and others were injured so badly they needed removal.

The activity of the low and the high volatile esters of 2,4-D was compared in 1955 in fruit-sizing plots established at 30 different locations in southern California. In general, the observations indicated that the materials classed as low volatile esters caused more leaf curl and more roughness of the fruit rind than those classed as high volatile esters. Symptoms of undesirable effects did not occur in a few of the plots treated with low volatile ester material. However, in a Valencia orange orchard at Corona, the crop in plots treated with the low volatile ester was nearly eliminated due to thinning. At the same time, the sizes of fruits in plots treated with an equivalent concentration of the high volatile ester were increased without a reduction in numbers.

Consideration of the various factors related to the unusual injury found in several young lemon orchards late in 1955 suggests that the addition of the low volatile ester of 2,4-D to the oil spray mixture might be responsible. A search revealed that the isopropyl ester had been used in 1955 in oil spray applied to lemon orchards at Corona and at Fillmore and that the diethanolamine salt had been used in oil spray applied to a

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Amounts of Plant Growth Regulator in Sprays for Citrus

Purpose	Concentration		Milliliters added to 100 gallons*	
			Material with acid equivalent of	
	2,4-D ppm	2,4,5-T ppm	4 lbs.	3.34 lbs.
Oil Spray Amendment ...	4		3.2	3.8
Water Sprays for Control of Preharvest Drop				
Oranges	8		6.3	7.6
	16		12.6	15.1
Grapefruit ..		4	3.2	3.8
		8	6.3	7.6
Water Sprays for Increasing Fruit Size**				
Oranges	12		9.5	11.3
	16		12.6	15.1
	20		15.8	18.9
	24		18.9	22.7
Grapefruit ..		6	4.7	5.7
		8	6.3	7.6
		10	7.9	9.5
		12	9.5	11.3

* Pounds of acid equivalent of material being used.

** The correct concentration used for increasing fruit size is determined from the following table:

Concentration of Growth Regulator

Navel and Valencia Oranges	
Fruit Diameter	2,4-D Concentration
3/16"–¼"	12 ppm
⅜"–½"	16 ppm
⅝"–¾"	24 ppm
Grapefruit	
Fruit Diameter	2,4,5-T Concentration
¼"–⅜"	6 ppm
½"–⅝"	8 ppm
¾"–1"	12 ppm

LEMONS

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900 acres were planted the previous fall and winter. Also, some budding of old stumps took place. It is widely stated that some acreage of grapefruit was budded to lemons. Probably there are about 3,000 acres of new plantings of lemons in Florida. It has been reported that 50,000 boxes of Florida lemons will be processed into juice in 1956.

In Florida, as in Arizona, the production potential exists. The real impact—of the production—will be on both the fresh and processed products markets. One important reason—for California growers—for that impact is that the flow of lemons into products is not controlled in Arizona or Florida as in California. Yet important indirect effects can spill over into the fresh shipping market because—in terms of economic operations—the fresh and processed markets are more closely interrelated than they were in the prewar and immediate postwar years.

About 600 acres of lemon plantings in the California desert area can be documented, including nearly 100 acres from five to seven years old. More new lemon acreage may be in prospect for the California desert area. However, the cold winter temperature—with the resulting risk of freeze damage to the trees—is a major uncertainty and is likely to be the main limiting factor, although there seems to be some opinion that there are sufficient warm sections, as in the Coachella Valley, where lemons can be grown successfully.

As in the Yuma Mesa and the Salt River Valley of Arizona, California desert lemons are mainly a once-a-year crop, with the economic outlook depending a good deal on the strength of the lemon products market.

When potential new plantings and lemon production are considered, developments in foreign countries must not be neglected. With the economic incentive, Italian production could well increase and provide additional export surplus in the form of products destined for the American market. In addition to Italy, lemons from Chile, Spain, and Turkey enter into world commerce. The effects of such potentialities are of direct concern to the outlook for the products market as an outlet for domestic-grown lemons.

In consideration of potential production from new plantings of lemons, historically important producing counties in California—Ventura, Los Angeles, Santa Barbara, San Bernardino, Orange—require attention. Reliable data on nonbearing lemon acreage in California since 1950–51 show a relatively substantial increase for the past two years; but the total lemon acreage in the state is under the level of 10 years ago. Those earlier levels can be regained if growers anticipate profitable operations from expansion. Moreover, lemons from these sources are not fall harvested primarily for products but have direct effects on the fresh and the processed products markets.

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number of orchards in the vicinity of Corona. In addition to these, a continuous history of both isopropyl ester and diethanolamine salt forms added to single annual applications of oil spray applied to mature Valencia orange trees near Tustin was available for the period of 1946 through 1953. Evidence from surveys conducted in these orchards showed that damage to the trunk bark at the soil line or other symptoms of injury had not occurred from the use of the isopropyl ester of 2,4-D.

Careful use of the isopropyl ester of 2,4-D—at the correct concentrations—on mature trees should safely give the desired responses.

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POLLUTED AIR

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are important to the successful operation of the filters, they should be designed according to the engineering principles of air conditioning equipment.

Air Pollution Crop Survey

The occurrence and distribution of air pollutants in California were determined by reporting plant damage in a statewide experimental survey conducted in 1955. The response of plants to specific air pollutants permits the identification of toxicants, such as ethylene, fluorides, herbicides, ozone, sulfur dioxide, and oxidized hydrocarbons, or smog. Although instruments are available for the measurement of ozone, sulfur dioxide, and some atmospheric oxidants, there is no suitable instrumental measuring system for ethylene, fluorides, herbicides, and the airborne toxicants which cause oxidized hydrocarbon damage.

The survey covered 40 field and glasshouse-grown crops and eight sensitive weeds. A total of 2,668 reports from 51 counties showed 544 cases of plant damage due to air pollution in 12 counties in and about the San Francisco and Los Angeles areas.

Results of the air pollution crop survey in California in 1955. Solid black areas report plant damage; lined areas report no plant damage. No reports received from white areas.

The air pollutants responsible for plant damage are recognized in decreasing order of importance as smog or oxidized hydrocarbons, ethylene, fluorides, and sulfur dioxide. Smog is widely distributed within the air basins associated with urban development. Fluorides are apparently distributed near and on specific industrial sites. Ethylene seems to be confined to urban areas, although this may be due in part to the fact that ornamental plants, such as carnation and orchid, are usually grown near large population centers. Sulfur dioxide damage rarely occurred and was usually confined to specific industrial locations.

Surveys of economic loss to agriculture in the affected areas are in progress.

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