Growth Regulators

effect of 2,4-D investigated in studies on Washington navels

W. S. Stewart, L. J. Klotz, and H. Z. Hield

Satisfactory control of naval orange fruit drop is achieved by California citrus growers who have applied 2,4-D as a plant growth regulator on commercial acreage since 1947.

Operators generally add the 2,4-D to a mixture containing other spray chemicals such as zinc or manganese. No spray chemical was found incompatible with the 2,4-D. No reports of reduced yield, lower fruit quality, or tree injury were received when instructions were followed.

During the past five years 43 field experiments were made to determine the effects of 2,4-D and other plant growth regulators on preharvest drop of mature fruit, drop of young fruit, fruit stem dieback, water spot susceptibility, yield, fruit size and quality.

The experiments indicate that 2,4-D is effective in reducing mature—preharvest—fruit drop of Washington navel oranges grown in California under a wide range of environmental conditions.

Application of the chemical for fruit drop control was made successfully as early as October 15 and as late as April 15. These applications were effective in reducing drop until harvest in May.

Oil sprays containing 2,4-D and applied for pest control in August were also effective in reducing the drop of navel oranges as late as the following May.

Application of 2,4-D to reduce mature fruit drop of navel oranges was successful at low volumes of solution per acre as well as by drenching sprays. As the volume of solution per acre was decreased the concentration of 2,4-D was increased.

Although fewer trials have been made than with drenching sprays, very low volume applications—less than 10 gallons per acre—of high concentrations of 2,400 ppm—parts per million—of 2,4-D were effective in reducing preharvest drop when applied as a fog or fine mist by helicopter or by a high-pressure spray or with an extremely small disc orifice.

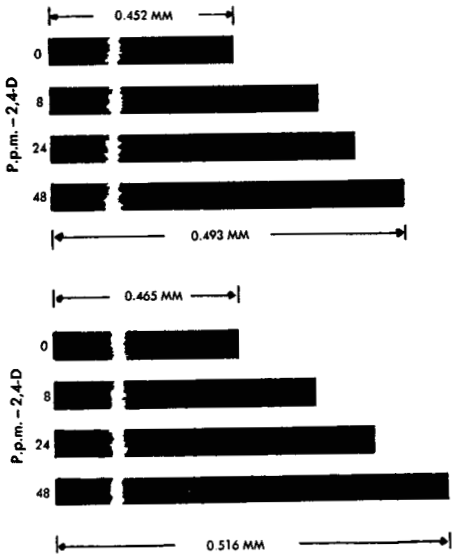
Application of the chemical as a drenching spray—1,000 gallons per acre or more—reduced mature fruit drop on an average of 56% when 2,4-D was used at eight ppm.

A solution containing 16 ppm 2,4-D, applied at a rate of 500 gallons per acre by spray-duster or some similar machine, also resulted in a satisfactory commercial control of mature fruit drop.

Application of the growth regulator as a dust was not as effective as a spray for reducing fruit drop.

In addition to delaying mature fruit drop of navel oranges, 2,4-D also reduced fruit-stem dieback.

Dieback is usually most severe toward the end of the harvest season, when the fruit may not drop but dries up and shrinks in size on the tree. The fruit stem may die from several inches to several feet back from the fruit, thus reducing the amount of fruit bearing wood for succeeding crops.



As shown above for two experiments, fruit on trees sprayed with 8, 24, or 48 ppm 2,4-D in June developed thicker stems than on non-sprayed trees, comparing fruit of equal size. This increase in the amount of stem in relation to the fruit probably contributed to the increase in fruit size of the sprayed trees at harvest.

In one experiment, 87% of the fruit on non-2,4-D-sprayed trees had dieback compared with 8% on the sprayed trees. Observations confirming this response were made on Valencia orange trees and grapefruit.

A commercial storage test of navel oranges from trees sprayed with 25 ppm 2,4-D indicated that the treatment has no undesirable effects on storage. Studies on the effect of 2,4-D sprays on lemon trees and of packing house applications of 2,4-D on lemons after harvest indicated that these treatments increase the storage life of the fruit.

No increase in yield was observed as a result of a decrease in June drop—shedding of young fruit in the late spring or early summer—from application of 2,4-D in various forms or concentrations, or from other growth regulators tested.

In some citrus growing districts of southern California there is a considerable loss of Washington navel oranges due to water spot—translucent, water-soaked areas in the rind which in severe form render the fruit unmarketable.

Susceptibility to water spot increases with fruit maturity, and is greater in fruit sprayed in the late summer with oil for pest control than on non-oil-sprayed trees.

June application of a spray containing 24 ppm 2,4-D appreciably reduced water spot susceptibility of the fruit.

Application of 48 ppm 2,4-D reduced water spot even more, to a point slightly above that on non-oil-sprayed trees. But the use of a spray solution containing more than 24 ppm 2,4-D is not practical as it possibly lowers fruit quality.

Application of 2,4-D to young fruit, or six to eight weeks prior to bloom at sufficiently high concentrations, generally induced an increase in fruit size at harvest. The increase was usually proportional to the concentration of 2,4-D. The size increase was primarily due to an accelerated growth rate.

Factors considered to contribute to this growth increase were: *1*, a thicker fruit stem in proportion to the fruit diameter; *2*, a direct effect of the 2,4-D in stimulating the growth of various fruit tissues; and *3*, in some cases, especially when applications were made at high concentrations near flowering, a reduction of the number of fruit per tree.

Annual applications of eight ppm 2,4-D in an oil spray for pest control were made for four consecutive years on Valencia orange trees. There were no indications of injurious or detrimental effects of the 2,4-D on the trees.

These results confirm the experience of citrus growers who have used 2,4-D on navel orange trees. One complaint, made in some instances, was that the spray reduced the drop of cull—unmarketable—fruit as well as that of healthy oranges. It was claimed that the increased cost of removing the cull fruit after harvest nullified the savings in sound fruit. But this view is not held generally, and when a severe drop of mature navel oranges is anticipated, or in progress, spraying with 2,4-D is becoming standard practice.

W. S. Stewart was Associate Plant Physiologist when these experiments were conducted.

L. J. Klotz is Professor of Plant Pathology, University of California College of Agriculture, Riverside.

H. Z. Hield is Laboratory Technician, University of California College of Agriculture, Riverside.

The above progress report is based on Research Project No. 1346.