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DISCARD

DDT RESIDUE PROBLEMS ON APPLES AND PEARS

by

R. H. Robinson, Chemist

AGRICULTURAL EXPERIMENT STATION
Oregon State College
Wm. A. Schoenfeld, Director
Corvallis

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In 1946 over 46,000,000 pounds of technical DDT were manufactured in the United States. As this was diluted into various formulations, it means that many times this quantity of the insecticide was actually utilized last year. A large portion of the various DDT formulations was used by agricultural industries for the control of insect pests on fruits, vegetables, and forage crops.

One of the more serious problems arising from the use of DDT on food crops is the existence of residues resulting from excessive applications. A great deal of controversy has taken place on this subject. The purpose of this circular of information is to indicate the tolerance limits in the use of this insecticide as a spray or dust on apples and pears. Since DDT has proven very effective in controlling codling moth with these fruits, it is being used by many orchardists this season (1947).

DDT Toxicity Low

Although the toxicity of DDT to humans is relatively low, care must be exercised so excessive residues will not be on the crop at harvest time. DDT toxicity is much lower than that of such insecticides as the arsenicals, fluorides, and nicotines. Obviously, DDT residues on food must be far below the amount that might cause any ill effects to humans. At present a tentative tolerance of 7 ppm (parts per million) is allowed on apples and pears by the U. S. Food and Drug Administration. Quite extensive study has indicated that this tolerance is well within the limits of safety. This tolerance is approximately the same as the prevailing lead tolerance of .05 grain per pound. To insure that all fruit that goes into interstate commerce meets this tolerance, care must be exercised by orchardists to follow proper recommendations in the application of DDT sprays.

Chemical Analysis Made

Chemical analyses have been made during the past few seasons to learn the amount of DDT deposited on fruit after each cover spray and the accumulation that remained at harvest time. Results are given in the table showing the parts per million of DDT at harvest on fruits obtained from both experimental plots and orchards located in various fruit districts of the state.

DDT RESIDUE ON FRUIT AT HARVEST

Fruit	No. of Sprays	Amount DDT used	Time between last spray and harvest	Parts per million DDT
Apples	1	1 lb.-100 gal. + spreader	4 months	1.1
"	2	1 lb.-100 gal. + spreader	2 $\frac{1}{2}$ "	6.3
"	2	$\frac{1}{2}$ lb.-100 gal. + spreader	2 $\frac{1}{2}$ "	4.1
"	2	$\frac{1}{2}$ lb.-100 gal. + 1 qt. oil in 1st.	2 $\frac{1}{4}$ "	4.5
"	2	$\frac{1}{2}$ lb.-100 gal. + 2 qt. oil	2 $\frac{1}{2}$ "	7.4
"	2	$\frac{1}{2}$ lb.-100 gal. + 1 gal. oil in 2nd	3 "	7.8
"	3	$\frac{1}{2}$ lb.-100 gal. + spreader	3 "	2.0
"	3	$\frac{1}{2}$ lb.-100 gal. + deposit builder.	2 $\frac{1}{4}$ "	7.2
"	4	$\frac{1}{2}$ lb.-100 gal. + spreader	3 "	2.6
Pears	1	$\frac{1}{2}$ lb.-100 gal.	2 days	4.2
"	3	$\frac{1}{2}$ lb.-100 gal.	2 weeks	3.8
"	4	$\frac{1}{2}$ lb.-100 gal.	2 "	4.2
"	4	$\frac{1}{2}$ lb.-100 gal.	6 "	3.2
"	1	Ground dusted, 50-60 lb. per acre 10% DDT dust.	3 days	.9 to 2.8
"	1 dust	Airplane dusted 60-80 lbs. per acre 10% DDT dust	1 "	.5 to 2.6
Peaches	1 dust	4% DDT dust	2 weeks	2.7

The results shown in this table indicate that DDT combinations will not leave residues at harvest in excess of the 7 ppm when applied according to recommendations. Oils and deposit builders, especially when used in the last cover spray, may cause residue difficulties. Petroleum oil in combination with DDT has caused injury to some varieties of apples and pears. Therefore, it is not recommended until more experimental data is available.

Perhaps the most important factor in the residue problem is the increase in the weight of the fruit between the last spray application and harvest. An increase in weight will reduce the proportion of DDT accordingly. The fact that DDT does not "weather-off" make this factor more important. Calculations show that under Oregon conditions practically all the DDT put on the green fruit in the last cover spray remains without chemical change. It is therefore present as a residue at harvest.

Recommendations for Avoiding Excess Residue

On apples no residue difficulties should materialize if two DDT applications are made for first brood worms and a third application, $\frac{1}{2}$ lb. to 100 gallons of water, at the time the second brood worms begin to hatch. This should not be done much later than the middle of July.

For pears no residue difficulties should occur with the three spray application schedule even when the last application is made within two weeks of harvest.

Adjuvants to DDT sprays may increase deposit and contribute to residue difficulties. Petroleum oil combined with DDT increases the deposit materially and should not be used in the second brood application. Materials to control mites, such as DM-111, xanthone (Genecide), and hexaethyl tetraphosphate, in combination with DDT have not influenced the deposit. Effective deposit builders, however, may increase the residue to no practical purpose so should not be used in the last cover spray. Neutral spreaders that give even coverage have not caused residue complications.

Some growers who will use lead arsenate or cryolite in first brood sprays or later because of mite infestations may desire to apply a DDT spray for a few days or a week before harvest in order to stop late worm entries. DDT used at the rate of 1/4 pound ($\frac{1}{2}$ lb. 50%) to 100 gallons will not leave a residue in excess of 7 ppm.

Only limited chemical analyses have been made of fruit which had been airplane or ground dusted. The effectiveness of dusting in those areas where it may be practicable has not been established. Chemical analyses of duplicate samples show appreciable variations, but it is apparent that the amount of residue at harvest would be well below the 7 ppm tolerance even though as many as six dust applications are made.

Many growers will use DDT this season on peaches primarily for the control of the 11-spotted cucumber beetle. Analyses indicate that dust applications made two weeks before harvest deposited a maximum of 2.7 parts per million on the fruit. No complications should be anticipated from the use of 10 percent or lower DDT dusts.

Washing Treatments for DDT Residue Removal

Not too much encouragement can be given for the removal of DDT residue at harvest by the washing treatment. If apples are washed immediately after harvest or before much wax forms on the surface, about 30 percent of the residue, or the portion that adheres lightly, may be removed by simply processing the fruit in the washing machine containing only fresh water. When fruit is stored, wax accumulates on the surface and part of the DDT actually dissolves in the waxy coating. Also, if petroleum oils have been combined with DDT in the last cover spray, the DDT blends in with the oil and waxy surface. In both cases very little of the DDT may be taken off by the water washing process. Fruit washed in water heated to 95° F. and containing sufficient wetting agent to create a good foam in the machine will remove varying amounts depending upon the wax or petroleum oil-wax residue present on the fruit. Hydrochloric acid is no more effective than water in the removal of DDT residue. Sodium silicate, while not recommended for washing pears, if heated to 100°F. or above, will remove variable portions of the DDT, depending upon the amount of wax taken off the surface by the detergent action.