Tomato Insects

northern California investigations with chlorinated hydrocarbon insecticides

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The 1948 season marked the end of the second year in which DDT and DDD insecticides were used extensively for the control of insects attacking tomatoes.

In that year nearly all the acreage was treated with one or the other of these materials.

Whether or not this widespread use of these new insecticides exerted an influence upon normally unimportant pests of tomatoes is not definitely known. However, there was an increase in certain pests. The most noticeable was that of a leafminer—*Liriomyza.* By the end of the season this insect was abundant in most fields, and caused considerable defoliation. On the whole, this occurred so late that little damage was done. It is possible that some good resulted as it opened up the vines and allowed the fruit to ripen. Further, it encouraged a drier environment, which had a tendency to reduce the amount of mold. In at least two fields defoliation occurred so early in the season that there was a serious loss of fruit due to sunburn.

The salt marsh caterpillar was also present in more than usual numbers, and caused minor damage by feeding on the surface of ripe fruits. A spider mite, probably the Pacific mite—*Tetranychus*—appeared in abundance in several fields and did some damage.

In some fields treated with DDD there appeared to be more than the usual number of tobacco flea beetles—*Epitrix pervula.*

The addition of sulfur to the insecticides used in the experimental plots resulted in excellent control of the tomato mite—*Phyllocoptes destructor.* In none of the experimental fields was the pest even encountered. This was general throughout the tomato producing area where sulfur was used in conjunction with the insecticides applied for the control of caterpillars. However, there were fields where the tomato mite was destructive. These occurred even where sulfur had been used. No opportunity was afforded to investigate thoroughly the conditions under which these infestations developed. Based upon reports it would appear that the prinicpal reasons for failure were due to one or more of the following reasons: *1,* applications timed too late; *2,* poor applications and coverage; *3,* insufficient sulfur in the insecticide; and *4,* insufficient material applied per acre. Besides the above reasons there is a slight possibility that in certain localities the mite may be developing a resistance to sulfur.

Residue Studies

Studies on DDT, DDD and calcium arsenate residue were conducted in 1947. The tomatoes used were obtained from experimental plots and were washed in the laboratory by a standardized procedure, considered comparable to a cannery wash.

In the 1948 residue studies tomatoes from small replicated plot experiments were handled in the same manner. However, those obtained from commercial experimental treatments were put through a commercial washer at a large tomato cannery.

Results

The results obtained—in general—are similar to those obtained in 1947, but the residues of DDT and DDD on the commercial samples tended to be a little lower than those found in 1947.

Toxaphene residues, particularly in the samples treated with 40% wettable powder applied as a spray, were somewhat higher than residues of the other insecticides. The residues of DDT and DDD were extremely low in all of the washed samples and in all of the juice samples that were tested.

In substantiation of the results obtained in 1947 the data show a marked concentration of DDT and DDD in the tomato pomace. The results obtained on the samples treated with 40% toxaphene wettable powder indicate that toxaphene like DDT becomes concentrated in the tomato pomace during juice extraction.

In further agreement with the results obtained in 1947, the data show that residues of calcium arsenate, although higher than DDT or DDD, in the unwashed tomatoes are more effectively removed in the wash and after washing has approximately the same concentration as the other insecticides. Also in agreement with the 1947 results is the fact that arsenic is more evenly distributed between juice and pomace than is DDT or DDD.

The relative effectiveness of the laboratory and the commercial washing treatment cannot be ascertained from this data. The effectiveness of removal appears to depend to a considerable extent on the amount of residue on the unwashed fruit, the wash being less effective with low concentration of residue than with high concentrations. The small amount of residue on the majority of the unwashed tomatoes makes it extremely difficult to obtain a true picture of the efficiency of either washing treatment.

Conclusions

With a single exception, the effectiveness and suitability of DDT and DDD as insecticides for the control of caterpillars attacking tomatoes have proved to be more effective than calcium arsenate. Against the tomato hornworm—*Protoparce sexta*—calcium arsenate is more effective than a 5% DDT dust applied at the rate of 30 pounds per acre. However, if an equivalent amount of DDT is applied as a wettable powder in a suspension spray or as an emulsion spray, satisfactory control is assured. Under northern California conditions not more than three applications of DDT or DDD are necessary to insure excellent control. For each application 1½ pounds of actual material should be applied per acre, which is equivalent to 30 pounds of a 5% dust or three pounds of a 50% wettable powder.

Other chlorinated hydrocarbons investigated were methoxychlor and toxaphene, a chlorinated camphene, the technical grade of which contained 67% to 69% chlorine.

This latter material applied as a 10% dust at the rate of 30 pounds per acre resulted in rather satisfactory control of caterpillars attacking tomatoes. Excellent control was obtained where it was used in combination with DDT. A dust containing 5% toxaphene and 3% DDT and applied at 30 pounds per acre per application warrants additional study.

Methoxychlor, both as a dust and as a water suspension spray, resulted in the poorest control of any of the chlorinated hydrocarbons investigated. Its range of effectiveness paralleled rather closely that obtained with calcium arsenate.

In order to insure the control of the tomato mite—*Phyllocoptes destructor*—the above-mentioned insecticides should be used in conjunction with sulfur. With dusts, the sulfur content should not be less than 50%. If injury by the tomato mite is not apparent by early September, the sulfur can be safely omitted from the later treatments.

The residue studies substantiate the information obtained in 1947. Under the conditions of the present experiments, with only a few exceptions, insignificant

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IRRIGATION

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The top layers of soil are filled to field capacity before water moves downward to the dry soil beneath.

The depth of penetration depends largely upon the amount of water, whether by rain or irrigation and upon the texture of the soil. A light rain wets the soil to a shallower depth than a heavy one. Furthermore, a given amount of water wets a loam soil to a shallower depth than a sand. For example, in a loam soil an inch of rain may penetrate five or six inches, while in a sand it may penetrate a foot or more. Conversely, the readily available moisture from a given depth will ordinarily be exhausted more rapidly from a sand than from a loam.

After walnut trees come into leaf, moisture begins to leave the soil. Most of the water moves out through the leaves by the process of transpiration, but some is lost by direct evaporation from the soil.

The movement of water out from the soil is somewhat different than the movement into the soil from rain as the roots extract it more or less uniformly. This gradual, fairly regular reduction of soil moisture may be used in judging when the available supply will be exhausted and when the first irrigation will be necessary.

The permanent wilting percentage is a characteristic of the soil. All plants seem to have the ability to reduce the soil moisture to the same extent.

If weeds in a walnut orchard show signs of wilting, it may be assumed that the trees are close to that condition also. Weeds, being shallower rooted than trees, wilt first.

Trees reduce the soil moisture in a given orchard to the same moisture content year after year. The permanent wilting percentage is a soil moisture constant that does not change with the passing years. Drouth resistance in trees is not due to their ability to extract more water from the soil than other plants; but to their ability to withstand long periods of dry soil conditions without dying.

Under conditions at Davis about three irrigations—wetting the soil to a depth of seven or eight feet—are adequate. The first two irrigations are applied before harvest and the third one as soon as possible after the crop is gathered. If the soil is wetted to a shallower depth, or is coarser in texture than the loam soil at Davis, more frequent irrigations may be necessary. As a rule all of the moisture from the last irrigation is not used before leaf fall, and the remainder, together with the rainfall, is sufficient to provide enough water to start the trees with a reservoir that is full or nearly so.

The irrigation schedule should be planned so as to interfere as little as possible with other orchard operations. Where spraying is necessary, irrigation water should be applied either sufficiently in advance of the spraying to allow the surface to dry before it is necessary to take the spray equipment into the orchard, or should be postponed until after the spray job is done. Likewise, the irrigation schedule should be so planned with regard to the harvest date that the nuts can be picked up from dry soil.

After harvest many growers feel that no more water is necessary. It should be pointed out that the leaves are still on the trees, and certain food manufacturing processes are still going on. While the leaves are on the trees, they use water whether there is a crop on the trees or not.

The last irrigation need not be as heavy as the early ones, but the exact amount may depend on the grower's ability to predict correctly the onset of winter rain. In most cases water not used during the fall months is not wasted, but is moved down by the winter rains and forms a part of the supply for the next season.

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STAKES

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weathering. All treatments appeared to be of some benefit to these woods. In some cases, Douglas fir showed superiority to eucalyptus.

The creosote oil treatments maintained their reputations of being superior. The crankcase oil bath cannot be considered significant, because of its unreliability, as indicated by variable results. Another weakness of such treatments lies in the wide variation in chemical composition of different samples of crankcase oil. Zinc chloride home treatments are apparently ineffective, according to these tests.

A study was made to check the relation between the amount of preservative absorbed and stake strength after 12 years. There seemed to be no conclusive relation between these two variables, but when the various points were plotted, a few observations could be made. Under a heavy retention of the treatment, good durability always resulted. Under light treatments there was considerable variation. Many of the brush treatments were surprisingly effective. Crankcase oil treatments varied widely, apparently being not dependable.

Only a few methods were consistently satisfactory. The creosote and Columbia baths were most consistent, followed by conservo, crankcase oil, selenium-tellurium, cold treater dust, and zinc chloride, in varying order for the three different kinds of wood.

Treatments listed in order of their values as preservatives considering average rank, dependabality, and effect upon nondurable woods, are: creosote, Columbia, crankcase oil, conservo, selenium-tellurium, cold treater dust, zinc chloride.

Recommended methods of application are listed in the order of their effectiveness: pressure, hot and cold bath, hot bath, two brush, one brush, cold bath—steep.

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INSECTS

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amounts of residue were present on the washed tomatoes and in the juice extracted from these tomatoes.

Considerably higher concentrations of residues were present in the pomace or residue from juice extraction, particularly with the new organic insecticides.

Arsenic was reduced to about the same level as the other insecticides after washing, but did not show as marked an increase in concentration in the pomace as did DDT, DDD and toxaphene.

It appears that there is no serious residue hazard involved with canning tomatoes where DDD, DDT or the DDT-toxaphene combination are used for the control of caterpillars attacking tomato. This is particularly true if these insecticides are not used at a concentration higher than recommended here.

In all cases in the samples from the commercial blocks, there were 0.05 ppm—parts per million—or less of residue in the juice and from 0.5 to 1.77 ppm in the pomace.

Because of the relatively higher residue in the tomato pomace, it probably should not be fed to livestock, particularly dairy cattle.

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