A REVIEW OF STUDIES ON MALATHION-TREATED RAISIN DRYING TRAYS

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BACKGROUND

For many years the raisin industry has been confronted with the problem of combating insects that attack raisins during drying in the field and in storage. During the past few years both government and consumer groups have increased their interest in demanding a cleaner and more wholesome raisin product. The industry is realizing more fully that in addition to the loss of the actual amount of commodity the insects damaged, the mere presence of insects in raisins is serious.

Several species of insects are attracted to grapes during the drying period and in storage. Those most commonly found during the drying period include the raisin moth, Cadra figulilella Gregson, the dried-fruit beetle, Carpophilus hemipterus (L.), and the vinegar fly, Drosophila species. When the raisins are placed in storage, they may continue to be attacked by such insects as the raisin moth as well as the Indian-meal moth, Plodia interpunctella (Hubner); the saw-toothed grain beetle, Oryzaephilus surinamensis (L.); and the merchant beetle, Oryzaephilus mercator (Fauvel). Studies were begun by the Dried Fruit and Tree Nut Insects Investigations in Fresno dur ing the spring and summer of 1961 on the use of malathion-treated paper raisin-drying trays to control insects in raisins. These studies have continued to the present time.

PROCEDURE

1961-1962 Studies -- The trays used in the tests were treated with premium-grade malathion applied as an emulsion with a hand sprayer. Two levels of malathion were applied to the trays. One group of trays received 428.4 mg/sq ft and the other 806.4 mg/sq ft. There was also a group of untreated trays.

These trays were placed in a vineyard near Sanger, California. Samples of the paper were taken at the time the trays were placed in the vineyard and at the end of the drying period. Some of the grape vines received 3 dust applications before the grapes were picked. The dust contained 4% malathion and was applied at the rate of 35 lb/acre. The grapes were

removed from the vines and placed on the trays on the third day after the final dust application. All of the samples of grapes, raisins, and trays were submitted to a chemical laboratory for malathion residue determinations.

Observations were made during the drying period to determine the number and species of insects that were attracted to the grapes. At the end of the drying period samples of natural raisins were taken and examined for the presence of insects. Similar samples were taken at the end of the 5 months and 1 year in storage. Other samples of the natural raisins were taken at the end of the drying period and at the end of 5 months and 1 year in storage, and these were processed before testing to determine what effect processing had on the amount of malathion residue on the raisins.

Similar samples of the natural and processed raisins were exposed to the Indian-meal moth and the saw-toothed grain bettle in the laboratory to determine what residue levels were effective against the insects. Taste and odor tests were also made on the processed raisins that contained approximately 9 ppm of malathion.

Microanalytic studies were included to determine the amount of insect parts, eggs, and fragments present on the natural and processed raisins.

1962-1963 Studies -- The 1962-1963 study was a commercial-type test, involving about 5 acres in each of 2 vineyards near Fresno. The paper trays used in this study were treated with premium-grade malathion applied as an emulsion by the paper manufacturer. The average residues on the 3 groups of trays placed in 1 vineyard were, respectively, about 31.2, 152.4, 304.2 mg. of malathion /sq ft. Those used in the other vineyard contained an average of 34.2, 150.2, 290.4 mg/sq ft. Untreated trays were also used.

The main difference between this and the 1961-1962 studies was that the raisins were dried in 2 vineyards and that more raisins and trays were involved. Samples of the natural raisins were removed from stacks at the end of 3, 6, 9, and 12 months in storage. Bio-assay and microanalytic and taste panel studies were also included.

1963-1964 Studies -- During the 1963 and 1964 drying periods, small-scale studies were continued to determine if turning of the trays, type of roll used, and location of the vineyard affected the amount of malathion picked up by the raisins. It was also hoped that information could be obtained regarding the time during the drying period when most of the malathion migrated from the trays to the raisins. The trays were placed in the same vineyards in which the 1962-1963 studies were made, but only trays treated with malathion at the rate of 161 mg/sq ft were used.

1965 Studies -- In view of the unexplainable high residues of malathion resulting from the 1964 studies, a cooperative study was set up with the California Raisin Advisory Board to gain additional information on the amount of malathion imparted to the raisins when dried on trays treated with malathion at the rates of 106 and 183 mg/sq ft. Six locations through the raisin drying area were used. The results of this study are not available at this time.

RESULTS

Information gained from these studies can be stated briefly as follows:

It was shown that paper raisin-drying trays could be treated with malathion applied as an emulsion.

Insects attracted to the grapes drying on malathion-treated trays were killed, and they remained among the raisins at the end of the drying period. Screening these raisins removed dead insects before the raisins were boxed for storage.

The number of insects attracted to the drying grapes depended largely on the amount of bunch rot or number of injured grapes present on the trays, as well as on the number of insects in the general area.

Raisins dried on malathion-treated trays contained more insect eggs, insect parts, and fragments than those dried on untreated trays. There was a direct relationship between the number of dead insects and the amount of foreign material on the raisins.

Vines supporting bunches of ripe grapes were dusted with a 4% malathion dust, and 3 days following the application an average of 0.35 ppm of malathion residue was present on the grapes.

Raisins dried on malathion-treated trays picked up varying amounts of malathion. These amounts were influenced by the tray treatment, factors associated with location of vineyard, and the drying season.

There was no consistent evidence that turning of the grapes on the trays during the drying period or the type of roll used affected the amount of malathion picked up by the raisins.

Processing removed up to one-third of the malathion present on natural raisins and greatly reduced the number of insect fragments.

Malathion residues of 2 ppm or more protected natural raisins for at least a year in farm-type storage and protected natural and processed raisins exposed continuously to the Indian-meal moth and saw-toothed grain bettle for the same length of time in the laboratory.

Natural raisins that had been dried on malathion-treated trays and containing varying amounts of malathion lost up to one-third of the malathion during 1 year in farm-type storage.

Malathion residues of about 9 ppm on processed raisins did not affect the odor or flavor of the raisins.

Establishment of Tolerance

On the basis of the information obtained from the 1961-1962 and 1962-1963 studies, a tolerance was established by FDA, HEW for malathion residues on raisins resulting from the use of malathion-treated trays. The tolerance specifies that the trays shall not contain malathion in excess of 200 mg/sq ft and that processed raisins dried on such trays shall not contain more than 8 ppm of total malathion residues. This includes any malathion that may have been present on the grapes themselves at the time they were placed on the treated trays to dry.

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Grower Cooperators -- The following are the grower cooperators who tested the trays during the 1965 raisin drying season:

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