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Effect of Soil Systemic Insecticides on Flavor and Residue in Coffee

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Flavor tests and residue analyses were made on coffee beans harvested from trees treated with the systemic insecticides phorate, disulfoton, Bidrin granular, Bidrin resin pellets, as well as an untreated check. Residue analyses were performed on samples harvested 30 days after treatment; harvests for flavor tests ranged from 53 to 86 days. Expert tasters ranked the samples numerically, attempted to separate some treatments by the triangular method, rated the samples by differences and preference scales, and subjectively evaluated the flavor. Green coffee beans from all treatments were analyzed for total phosphorus, and those treated with disulfoton were further analyzed by paper chromatography for the pesticide and its metabolites. No foreign odor or flavor was present in any of the samples; in some series, treated samples appeared slightly superior to those untreated. Absorbances of phosphorus from all samples were essentially the same, and no detectable residues of disulfoton or its metabolites were found.

The history of the coffee leaf miner, *Leucoptera coffeella* (Guerin-Meneville and Prrott.), in Guatemala denotes that this microlepidoptera has been the most important insect pest of coffee during the past 50 years, and has been especially persistent since 1949. This insect is a major pest throughout the coffee-growing regions of Africa and Central and South America.

The senior author first had contact with the coffee leaf miner in 1961. In 1964, an intensive study was initiated in Guatemala to find a more practical solution to this problem, and some recommendations resulted from studies in which oil was used in combination with insecticides in spray applications (Rodriguez *et al.*, 1966), and from experiments in which various insecticides were used as sprays (Campbell *et al.*, 1967).

Another method of control that merited investigation was the use of systemic insecticides used as soil applications to the coffee tree. One of the advantages in using such a method of attack on the coffee leaf miner is that control of a preventive type is long-lasting (Perez Escolar, 1965). Many biological tests were conducted in Guatemala by technical representatives of commercial companies, and some corroborating tests were conducted by the Asociación Nacional del Cafe (1964). Soil applications of phorate or disulfoton were effective in preventing or controlling infestations of the coffee leaf miner. Grower acceptance would come about unless good reasons were found not to recommend this practice.

The objective of this work is to investigate possible residues that might occur from soil application of the long-lasting systemic insecticides and, concomitantly, to test for any detectable off-flavor that might result in the coffee brew.

EXPERIMENTAL

Granular formulations of phorate, *O,O*-diethyl *S*-[(ethylthio) methyl]phosphorodithioate, disulfoton, *O,O*-diethyl *S*-[2-(ethylthio)ethyl)]phosphorodithioate, Bidrin, 3-hydroxy-*N,N*-dimethyl-*cis*-crotonamide dimethyl phosphate, and a resin pellet formulation of Bidrin were used. This was designated as Bidrin, XP657 resin pellets (20%). The materials were sprinkled at the base of trees (12- to 18-inch radius from the trunk) 5 to 6 feet tall in a block that had been lightly attacked by the leaf miner the previous year; in general, the whole plantation had been heavily attacked since about 1950. This plantation, Finca Parraxe, in Samayac, Suchitepequez, is situated at elevations of 2300 to 2700 feet.

Phorate and disulfoton (10% granular) were applied at 12.5, 25, 37.5, and 50 grams per tree. Bidrin 5% granular was applied at 25, 50, 75, and 100 grams per tree, while the Bidrin 20% XP657 resin pellet formulation was applied at 8, 16, 24, and 32 grams per tree. There were 10 trees per plot and these were replicated 3 times at random. The materials were applied August 22, 1964, during the rainy season. The coffee berries were picked as they ripened on September 21, October 14 and 28, and November 16, 1964. These pickings will be referred to henceforth as the first, second, third, or fourth pickings or harvests. The elapsed time between treatment and harvest for each interval was 30, 53, 67, and 86 days.

Processing. In preparation for the taste tests, the harvested coffee berries were treated as follows: On the same day that the berries were picked, they were cleaned of extraneous material and abnormal berries, and were depulped. The beans were then put to ferment in plastic bags, partially washed at the end of 24 hours, leaving some of the fermenting liquor in the bags, then washed further 24 hours later. They were set to dry in the sun in open-mesh fabric bags until they reached a state of approximately 10% moisture.

After drying, the parchment skins were hulled off the beans, then the beans were screened to remove abnormally large or subnormally small sizes, and those having off

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