DISTRIBUTION AND PERSISTENCE OF 1,2-DIBROMO-3-CHLOROPROPANE IN SOIL AFTER APPLICATION BY INJECTION AND IN IRRIGATION WATER

BY

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Applications of 1,2-dibromo-3-chloropropane (DBCP) were made to mini-field plots of Yolo sandy loam by means of injection, flooding and sprinkler irrigation. Soil samples were removed at various depths and time intervals, processed to extract the chemical and the amount present determined by gas chromatography and correlated to the degree of kill of Meloidogyne incognita. Deepest penetration in soil occurred by injection. Application of water to injected plots moved the chemical deeper into the soil than no irrigation. In flood applications most of the chemical was retrained near the soil surface with only small quantities reaching a depths of 15 cm. Application by sprinkler resulted in shallow penetration. Excellent correlation between depths of chemical penetration and nematode kills were obtained.

Since McBeth & Bergeson (1955) first reported 1,2-dibromo-3-chloropropane (DBCP) to be a nematicide it has been applied in several ways. Injection directly into soil and addition to irrigation water have proved to be the most effective methods of application.

DBCP exhibits low phytotoxicity to many plants and hence, often is used to treat soil in which perennial crops are growing or to treat soil immediately prior to or at the time of planting. Consequently, the method and time of application are selected frequently for convenience of the grower. Since applications often are not made under optimum conditions, treatment is often of questionable merit.

Although numerous papers deal with methods for applying DBCP and assessing its efficacy, there has been no quantitative work to correlate the distribution and concentration in field soil with nematode control. All previous field studies have used bioassay to estimate the movement and approximate concentration of DBCP in soil. Assessments of this type can lead only to qualitative or, at best, semi-quantitative results.

Johnson (1968) and Johnson & Lear (1968, 1969a) laid the base for this study by evaluating the dispersion of DBCP in soil under laboratory conditions. They developed a simple gas chromatographic method (1969b) that is very efficient for detecting small quantities of DBCP in soil treated by injection and in water.

The objective of this investigation was to use quantitative methods to determine the most efficient methods of applying DBCP to field soil to control nematodes.
Applications were made by injection of the fumigant directly into the soil, with and without subsequent irrigation, or by mixing it with irrigation water followed by either flooding or sprinkling the surface of the soil. Detection and quantification of DBCP in soil at various depths were made using gas chromatography. These data were correlated with percent of *Meloidogyne incognita* (Kofoid & White) Chitwood that remained alive in treated soil. Thus, it was possible to determine the concentration-exposure time necessary to kill *M. incognita* after different methods of application and at various depths in soil.

**MATERIALS AND METHODS**

_Evaluation of methods used to apply DBCP to soil_. The soil treated in this study was a Yolo fine sandy loam containing 52, 26 and 22% sand, silt and clay, respectively. The moisture equivalent was 17.4% and the permanent wilting percentage 9.0%. The carbon content as determined by dry combustion was 1.08%. This soil was chosen because it had a high population of *M. incognita*, is widely distributed in California, and is of major agricultural importance to the state. The soil is deep, permeable and suitable for a wide range of crops.

The field in which the plots were located was planted to tomato for several years previous to the experiments with DBCP. Each year, after the tomatoes were harvested, the field was disked and the tomato plants allowed to decompose through the fall and winter. In the spring, the field was disked and harrowed in preparation for seeding tomatoes. The portions of the field selected for the DBCP plots were not bedded up or planted to tomato. In order to assure a heavy population of *M. incognita*, all plots were located on a strip of land approximately 7 m wide and 50 m long that ran through the center of the tomato field.

The soil, maintained fallow for several months prior to the application of DBCP, was flood irrigated with 4 to 8 cm of water to settle the surface, allowed to set for at least 2 weeks and rototilled to the depth of 10 to 15 cm. The soil was undisturbed below the depth of tillage.

All applications were made when the mean daily soil temperature, at a depth of 20 cm, was between 25 and 29°C; the surface of the soil was dry and contained 3.5 to 4.0% moisture (20 to 25% of the moisture equivalent); and the soil at a depth of 20 cm contained 11.5 to 15.0% moisture (67 to 86% of the moisture equivalent). Air temperature varied from a low of 20°C to a high of 38°C at the time of application.

DBCP was applied to soil by four methods: (1) injection; (2) injection immediately followed by flood irrigation; (3) mixing with water used for flood irrigation; and (4) mixing with water used for sprinkler irrigation. Three rates of DBCP were used for each method of application (12 different treatments). The actual concentration of DBCP applied by each method was equivalent to 9.35, 23.35 and 46-75 l per hectare. All treatments were made with a commercially available formulation of emulsifiable DBCP.

Injection and flood-application treatments were made to circular areas 56.6 cm in