Some Effects of 2,4-D, DDT, and Colorado 9 on Root Nodulation in the Common Bean

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In the course of testing various hormone-like chemicals for their growth stimulating and weed killing properties, it was observed that bean plants, *Phaseolus vulgaris*, growing in soil previously treated with low concentrations of 2,4-D (2,4-dichlorophenoxy acetic acid) failed to develop bacterial nodules. In areas where legumes are necessary for maintaining soil fertility, a treatment that would depress, inhibit, or increase development of bacterial root nodules would have a far-reaching influence. Therefore this aroused an interest in the determination of how low a concentration would inhibit nodule formation and further suggested that possibly other antibiotics and insecticides such as DDT (1,1,1-trichloro-2, 2-bis(p-chlorophenyl)ethane) might have an effect on legume root nodulation.

The recent work of Appleman and Sears has indicated that DDT applied to sand or soil at high concentration (1,000 to 10,000 pounds per acre) depressed root nodulation and average plant height. This has suggested that possibly other materials similar to DDT in their insecticidal properties might be found which could be used, yet would not interfere with nodulation.

The objectives of this paper have been (1) to determine the lowest concentration at which 2,4-D interferes with nodulation and (2) to determine the effect of DDT and Colorado 9 (1,1,1-trichloro-2, 2-bis(p-bromophenyl)ethane) on nodule formation.

MATERIALS AND METHODS

The DDT and Colorado 9 used in this experiment were prepared in the chemistry laboratories of the Colorado Agricultural Experiment Station at Fort Collins, Colo. The compounds were purified by recrystallization with an alcohol-ether mixture (one-fourth ether and three-fourths 95% alcohol) until the DDT melted at a constant temperature of 107 °C, and the Colorado 9 melted at 141.5 °C. No effort was made to isolate pure isomers of either compound. In the case of DDT, the constant melting point of 107 °C represents a stable mixture of isomers, the p,p' form predominating. This is the effective isomer as far as its insecticidal properties are concerned. The 2,4-D used was J. T. Baker's 2,4-D free acid, lot number 41946.

Six-inch clay pots, each containing 1,650 grams of soil (1 part sand and 3 parts clay-loam) were used. Pots containing the treated soil were prepared by spraying with 15 ml of the solution under test. After drying, the soil from each pot was emptied on a clean sheet of paper, thoroughly mixed, and replaced in the pot. Thereafter eight beans were planted at a depth of 1 inch and the pots were watered. Following germination, the plants were thinned to five plants per pot. The beans

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