FACTORS AFFECTING THE NEMATICIDAL ACTIVITY OF DIMETHYL DISULFIDE

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The citrus nematode, *Tylenchulus semipenetrans*, is widely distributed throughout the grape production fields in California. This nematode is an ectoparasite that feeds on epidermal and outer cortical root cells which can cause overall reduction in vineyard productivity. Pre-plant fumigation with methyl bromide (MBr) has been the key tool to decrease the crop damage made by citrus nematodes and other soilborne pests and pathogens. As the ozone-depleting molecule MBr is been phased out under the provisions of the Montreal Protocol and U.S. Clean Air Act, the introduction of alternative strategies has gained importance. A fumigant that has recently shown to have relatively broad pest control spectrum is dimethyl disulfide (DMDS). DMDS has relatively low herbicide activity but has shown to control different soilborne pest and pathogens including nematodes. However, the effectiveness of DMDS has been mainly investigated on root-knot nematodes (*Meloidogyne* spp.) and information describing the factors that may affect DMDS efficacy is limited. To optimize the factors that increase DMDS efficacy is of importance to determine whether this compound can be utilized as a post-planting fumigant in an integrated nematode management program in grape production systems of California. Therefore, the aim of this investigation was to determine the factors that affect DMDS efficacy against citrus nematodes.

OBJECTIVES:

1) Determine the sensitivity of citrus nematodes to DMDS
2) Evaluate the effect of time of exposure, soil moisture, and temperature on DMDS efficacy
3) Compare the effectiveness of DMDS in two different soil types

STUDY METHODS: Laboratory tests were carried out using DMDS (analytical grade) and citrus nematodes obtained from a San Joaquin loam soil in a commercial orange orchard near Visalia, California. In a sensitivity test, citrus nematodes were exposed for different time periods to a solution containing 0, 32, 64, 128, or 256 mg a.i./L and the number of active, inactive and dead nematodes was determined.

In efficacy tests, soil containing citrus nematodes was treated with DMDS at 0, 32, 64, 128, or 256 mg a.i./L air space. The effect of time of exposure (6, 24, 96, and 192 h), soil moisture (10, 30 and 60% water holding capacity, WHC) and temperature (9, 26, and 37±1°C) on DMDS efficacy was investigated.

The soil type test compared the effectiveness of DMDS between a Hanford fine sandy loam soil collected near Parlier, CA, and a Traver loam soil from Madera, CA.

RESULTS: The sensitivity test showed that after 3 and 6 h of exposure, citrus nematodes were mainly active in the lowest dosages and inactive at the highest dose tested where less than 20% nematode mortality was obtained. However, after 24 h of exposure nematode mortality was substantial in the 64, 128 and 256 mg a.i./L dosages. After 192 h, all nematodes were either inactive or dead in dosages of 64 mg a.i./L or more.

The DMDS efficacy (%) against citrus nematodes increased as the dose and time of exposure increased. The lower dosages (0-128 mg a.i./L soil air space) gave less than 60% efficacy when exposure time was 6, 24, and 96 h. DMDS had 80% citrus nematode control efficacy when it was applied at 32 mg a.i./L soil air space or more when incubated for 192 h. The soil water content affected the efficacy of DMDS, in particular at the lowest concentrations (32-64 mg a.i./L soil air space) and higher water content (60% WHC). At low rates this fumigant had generally better citrus nematode control effect in soil moistures of 10 and 30% WHC. However, at the highest dosage tested (256 mg a.i./L soil air space) it appears that soil moisture content did not affect the efficacy of DMDS. Similarly, temperature of incubation was a factor that did not affect DMDS efficacy.

The soil type test showed that DMDS had higher effectiveness against citrus nematodes in the Hanford fine sandy loam soil than in the Traver loam soil in the lowest DMDS dosage (32 mg a.i./L air space). However, at higher concentrations the soil type did not affect DMDS effectiveness been equal in both soils tested.

CONCLUSIONS: This study indicated that low dosages of DMDS require several days of exposure to be effective against citrus nematodes whereas high rates cause nematode mortality within few hours. It appears that DMDS is more effective in soil with low moisture when low rates are used. However, soil moisture was not an important factor affecting DMDS efficacy in the high dosages. Soil temperature did not play an important role in DMDS efficacy in the laboratory conditions. The soil type may be an important factor when applying DMDS at low rates but at high dosages it is less important.