

Sodium Tetrathiocarbonate - Potential New Fungicide For Control of Phytophthora in Citrus Groves

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ABSTRACT

Sodium tetrathiocarbonate (STTC) releases carbon disulfide when added to water and applied to soil. Laboratory tests were conducted to determine the effect of this chemical on growth and sporulation of Phytophthora citrophthora and P. parasitica, which cause Phytophthora gummosis and root rot of citrus in Arizona. Zoospore motility, zoospore cyst viability, sporangia production, and mycelial growth were significantly reduced in the presence of STTC. Results of laboratory tests suggest that application of STTC as a soil drench could reduce inoculum production and subsequent new infections by P. citrophthora and P. parasitica.

INTRODUCTION

When added to water and applied to soil, STTC (GY-81, Unocal Corporation) releases carbon disulfide. Carbon disulfide was first used as a partial soil sterilant in 1894. During a recent field trial in two Yuma orange groves, application of this material reduced the subsequent recovery of Phytophthora parasitica from treated soil, suggesting that STTC may inhibit inoculum production by this plant pathogenic fungus. Laboratory studies were initiated to determine the effects of this chemical on various stages in the life cycle of P. citrophthora and P. parasitica.

MATERIALS AND METHODS

Sporangia were produced by growing P. citrophthora and P. parasitica on an agar medium, then placing agar disks containing the fungus in a soil extract for 72 hr at 70 degrees Fahrenheit. Sporangia were induced to release zoospores by chilling at 40 degrees Fahrenheit for 20 minutes. Zoospores then were added to solutions of STTC to study the effect of the chemical on zoospore motility and the formation and viability of zoospore cysts.

Citrus leaf disks colonized by P. citrophthora and P. parasitica were used to study the effects of STTC on sporangium formation in soil. In plastic pots, colonized leaf disks were buried 2 inches below the soil surface in a sandy loam field soil. The soil was drenched with water or solutions of STTC. After an incubation time of 3 days at 80 degrees Fahrenheit, leaf disks were removed and the number of sporangia along the margins of each leaf were counted.

The effect of STTC on mycelial growth of each fungus was determined by placing agar disks containing each pathogen in a nutrient broth amended with selected concentrations of the potential fungicide. After 3 days, radial growth of mycelia was measured from the edge of each agar disk.

RESULTS AND DISCUSSION

Results of this study reveal on inhibitory effect of STTC on various stages in the life cycle of P. citrophthora and P. parasitica (Table 1). The zoospore appears to be highly sensitive to the chemical; complete cessation of zoospore motility occurred after 4-8 minutes in the presence of STTC at 2.5 parts per million (ppm).

When zoospores do not encounter host tissue to infect, they encyst by producing a cell wall. When conditions are favorable, zoospore cysts can germinate and produce a microsporangium, which in turn releases a motile zoospore. Germination of zoospore cysts did not occur when zoospores of P. parasitica encysted in the presence of STTC at 12 ppm.

Inhibition of sporangium production and mycelial growth required higher concentrations of the chemical. Control of sporangium production by both species of Phytophthora was almost complete at a STTC concentration of 500 ppm, while restriction of mycelial growth was virtually complete at a chemical concentration of 1800 ppm.

Sodium tetrathiocarbonate currently is being developed as a nematocide. After STTC was applied to a sandy loam soil in a Yuma Mesa citrus grove, the carbon disulfide concentration decreased daily and could not be detected after 7 days. This suggests that multiple applications would be required to suppress Phytophthora activity.

The possibility of a single pesticide with activity against Phytophthora and nematodes is an interesting prospect. Further evaluation of sodium tetrathiocarbonate as a potential fungicide for control of Phytophthora gummosis and root rot of citrus is now in progress.

Table 1. Summary of inhibitory effects of sodium tetrathiocarbonate (STTC) on growth and sporulation of Phytophthora citrophthora and P. parasitica

Stage in life cycle of <u>Phytophthora</u>	Concentration of STTC (ppm) required for complete inhibition
Zoospore motility	2.5
Encysted zoospore viability	12
Sporangia formation	500
Mycelial growth	1800