

## INCREASING YIELDS OF GREENHOUSE TOMATOES IN A MAILE SILTY CLAY LOAM SOIL BY ALTERNATING THE ROW LOCATION

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### ABSTRACT

In a greenhouse trial, drip-irrigated tomato plants located between two rows of the previous crop yielded about 1 kg per plant more salable fruits and suffered less root damage from rootknot nematode (*Meloidogyne* spp.) than plants growing in the same location as previous crops.

### INTRODUCTION

Moisture is the most important soil factor contributing to high nematode populations in the soil (Norton, 1979). Godfrey (1929) found maximum root galling from *Meloidogyne* spp. at the optimum moisture range for tomato growth.

When tomatoes are drip-irrigated, the zone between rows remains relatively dry. This condition is enhanced in Maile silty clay loam soil (Hydric Dystrandep) which dries irreversibly and forms definite aggregates (Kratky et al., 1974). Because lateral water movement is greatly restricted in soil which has irreversibly dried, nematode counts prior to this trial revealed the absence of rootknot nematodes between the previously cropped rows, presumably due to the continuous dry soil conditions between the rows.

The objective of this experiment was to determine if the extent of nematode damage to tomato roots and salable yields would be affected by placing the tomato rows between rows of the previous crop.

### MATERIALS AND METHODS

This study was conducted in a plastic-covered greenhouse at the Mealani Experiment Station (800 m elevation) near the town of Kamuela, Hawaii. The Maile silty clay loam soil was last fumigated for nematode control with Telone in 1985. Subsequently, one cucumber and nine tomato crops have been grown.

The most recent crop prior to this study was tomatoes. Harvesting was completed in October, 1990. Roots of all the tomato plants were seriously infected with rootknot nematode. Root damage ranged from at least two large deformed roots plus numerous medium and small galls to total root deterioration.

'Tropic' tomato seedlings were transplanted on March 5, 1991 at alternate within-row plant spacings of 30 and 60 cm. Rows were spaced 1.6 m apart; one row was in the same location as previous

crops and the adjacent row was located halfway between the previous crops' row location. The experiment was arranged as a randomized complete block with four replications.

A total of 171 liters of water were applied per plant over the growing season by daily irrigations with Drip-In 2L irrigation tubing with 30 cm emitter spacings. This irrigation rate could be expected to promote a large rootknot nematode population in the soil (Kratky et al., 1989). Plants were fertigated 60 times with a total rate of 124 mL of Dyna-Gro (6N-1.3P-7.5K) per plant.

Fruits were harvested from June 13 through Sept. 12. After harvesting was completed, roots were rated on a single plant basis according to the degree of nematode damage: 1 = no damage; 2 = small (< 3 mm) galls; 3 = small, medium (4 to 8 mm) and large (> 8 mm) galls present; 4 = many galls plus two large deformed roots present; and 5 = many galls plus five or more deformed roots present or massive root deterioration.

## RESULTS AND DISCUSSION

Yields of both grade 1 and total salable tomatoes were approximately 1 kg per plant higher from plants located between rows of the previous crop than from plants growing in the same rows of the previous crop (Fig. 1). Soil samples from both treatment locations had similar pH and electrical conductivity values.

A visual rating of the roots following the final harvest revealed significantly less nematode-caused root injury in the tomato plants located between rows of the previous crop (Table 2). Also, these plants had significantly higher fresh weights of undamaged roots and roots which had only small galls present. Fresh weights of the more seriously injured roots did not differ significantly between the treatments. Apparently, yield relates more to the quantity of healthy roots than to diseased roots.

Considering that nematode counts revealed no rootknot nematodes in the area between rows of the previous crop, it was interesting to learn that a significant level of nematode damage to the roots could occur within the timeframe of this crop. Nevertheless, the practice of alternating row location from crop to crop offers a promising non-chemical method to reduce nematode injury and increase crop yields.

Dry soil conditions between rows would promote these benefits. Low irrigation rates and coarse-textured soils would foster dry soil conditions between rows. Irreversible drying of various tropical soils would increase aggregation, thereby creating a coarser soil texture in which there would be decreased lateral water movement. Drip-irrigated, irreversibly-dried soils would be expected to have lower soil moisture and resultant lower rootknot nematode populations in the zone between rows than soils which maintained a high capacity for lateral water movement. Therefore, the practice of alternating row location with alternate tomato crops would likely be more successful in soils with irreversible drying characteristics than in fine-textured soils.

#### LITERATURE CITED

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Table 1. Visual rating and fresh weight of tomato roots following a trial where plant rows were located either in the same rows or between rows of the previous crop.

Row location relative to the previous crop	Visual rating <sup>1</sup>	Fresh weight of roots		
		Visual rating		
		0.0 to 2.0	2.1 to 3.9	4.0 to 5.0
		g plant <sup>-1</sup>		
Same	3.9	7.9	13.0	22.3
Between	2.9	21.0	14.1	18.4
LSD (5%)	0.7	8.8	ns	ns

<sup>1</sup> 1 = no root damage; 2 = small galls; 3 = small, medium and large galls present; 4 = many galls plus two large deformed roots present; 5 = many galls plus five or more deformed roots present or massive root deterioration.

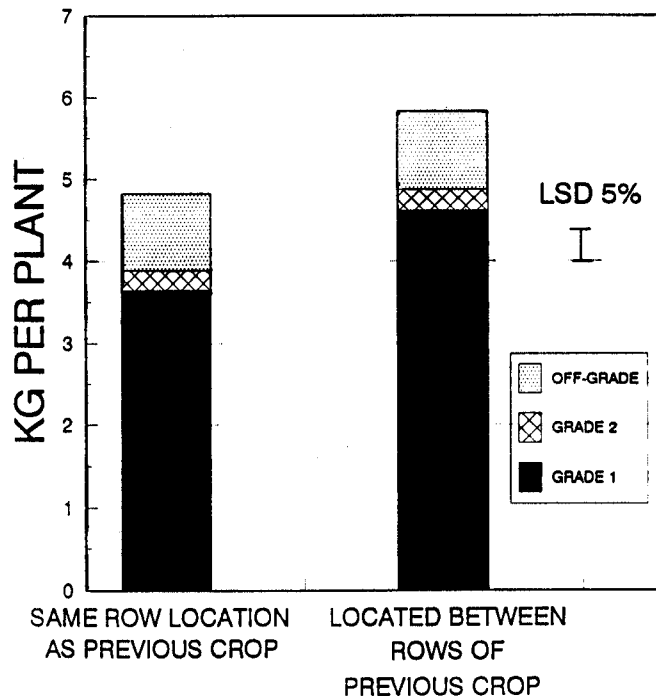


Figure 1. The effects of placing rows in the same location or between rows of previous crops on the yield of grade 1, grade 2 and off-grade 'Tropic' tomatoes in a non-fumigated, drip-irrigated greenhouse trial at the Mealani Experiment Station.