agar plate. One sample of boiled distilled water served as a control. Each sample was sieved through a clean autoclaved 3" diam 325-mesh sieve. The sieve was flushed with scalding water between samples. Sieve residues were washed into a centrifuge tube by flushing with water from the same sample which had already passed through the sieve. The centrifuge tubes were plugged with cotton. After 2 hrs the debris at the bottom of each centrifuge tube was pipetted out and examined on a precleaned, new slide. This procedure was repeated 12 hrs later. Two evaluations were made, one in 24 hrs and one in 72 hrs.

No bacterial or fungus colonies developed on agar plates inoculated from the control and 3 other samples. Two of the remaining samples produced an excess of 500 bacteria colonies in 24 hrs. The remainder produced 25. In 72 hrs all 3 infested plates had an excess of 500 colonies of bacteria. One culture had colonies with 2 color strains, a white and a pink. Another culture had colonies with 2 different growth characteristics. A single larval *Rhabditis* sp. was recovered from the system where the nematodes had previously been found. One sample contained 3 kinds of fungus spores. Two spores were attached to mycelia. In 6 of the 7 samples examined, short filaments of green algae were found which appeared to belong to the genus *Ulothrix*. Two pollen grains were found in 1 sample, and 1 amoeba was found in each of 2 samples.

Results of the two initial examinations revealed considerable contamination of the distilled water with many kinds of organisms, and two basic weaknesses in the distilled water systems. Contamination occurred in places where the apparatus was open to the atmosphere. All open places were correctable. The location of glass components in the presence of light could have contributed to algae growth within the system. Inorganic contamination resulted from fittings and components constructed of non corrosion-resistant materials. Such problems can easily be avoided by use of proper corrosion-resistant fittings.

It would seem justifiable for all research units using distilled water to periodically examine the effluent at its final outlet in order to preclude jeopardizing an experiment. For critical experiments heat treatment of distilled water might be advisable when not already a standard practice.

RESUMEN

Gran número de nematodos bacteriófagos *Rhabditis* sp. fueron hallados infestado un sistema de agua distilada. Cinco sistemas adicionales fueron examinados con el propósito de determinar contaminación en esos otros sistemas. Dos de 6 muestras se hallaron infestadas de bacterias. Una muestra extraida del primer sistema nemátodo infestado mostró solamente un *Rhabditis* sp. vivo. Hongos (un espécimen), algas (6 espécimenes), y amebas fueron hallados en las muestras.

A COMPARISON OF ANNUAL AND TRIENNIAL APPLICATIONS OF DBCP FOR CONTROL OF THE CITRUS NEMATODE [UNA COMPARACION DE APLICACION ANUAL Y TRIENAL DE DBCP PARA EL CONTROL DEL NEMATODO CITRICO]

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ABSTRACT

Annual application of DBCP (1,2-dibromo-3-chloropropane) (1.3 gal/A, 12.1 lb/gal ai, EC) to grapefruit trees infected with the citrus nematode resulted in more

effective control of the nematode than the normal triennial rate (4 gal/A 12.1 EC). Yield of No. 1 fruit (3-9/16 diam and larger) from both treatments increased significantly compared to that of the nontreated trees. Total yields, including fruit for processing, did not differ significantly.

INTRODUCTION

Since discovery of the citrus nematode (*Tylenchulus semipenetrans* Cobb, 1913) in the Lower Rio Grande Valley of Texas (2), little attention has been given to the yield loss that this nematode can cause to citrus. However, recent chemical trials have shown that significant yield increases are possible through use of various nematicides (3). As early as 1958, Sleeth (5) reported an increase in growth of young oranges and grapefruit trees planted in fumigated soil. Presently, growers are applying DBCP triennially to control the citrus nematode. This method is successful but it allows the population to increase to or above untreated populations by the end of the 3rd year. The initial expense of the nematicide is costly, and it would be beneficial to some growers if the cost could be spread over the years.

The purpose of this experiment was to compare the effect of yearly applications of 1.3 gal/A to triennial rates of 4 gal/A of DBCP on the nematode population and fruit yield.

MATERIALS AND METHODS

A 20-yr-old grapefruit orchard (*Citrus paradisi*, Macf. 'Ruby Red') on sour orange *(Citrus aurantium* L.*)* rootstock was selected for this experiment. The design was a randomized block with three treatments replicated three times. Each plot consisted of four rows of 35 trees each, with a tree spacing of 12.5 ft and 25 ft between rows. DBCP[1/] was applied at rates of 4 and 1.3 gal/A in the irrigation water with a gravity flow applicator in approximately 6 in of water. The 4-gal rate was applied once when the experiment began, and the 1.3-gal rate was applied yearly.

Soil samples for nematode analysis were taken from around the tree drip line. Samples consisted of 100 g soil and 3 g roots taken from a composite of six sites per replication and were processed by the Baermann funnel technique. Yields from two harvests were determined from the two center rows of each treatment. The first picking was a ring pick of fruit 3-9/16 in diam (size 96) and larger for fresh market, and the second picking was a harvest of the remaining fruit for processing.

RESULTS AND DISCUSSION

Citrus nematode counts (Table 1) showed that three annual applications of DBCP at 1.3 gal/A were superior to a triennial application of DBCP at 4 gal/A 3 yrs after the first application. The 4-gal rate reduced the population to a non-detectable level; however, after 2 yrs, the populations began to increase rapidly and 2.5 yrs later the populations exceeded those in the nontreated plots. Nematode counts in

[1/] All agricultural chemicals recommended for use in this report have been registered by the Environmental Protection Agency. They should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended by the Federal Environmental Pesticide Control Act.

the annually treated plots were decreased significantly after the first application and were beginning to increase at the time of the second application, but were held to low levels after the second and third applications.

Baines et al. (1) have shown that the citrus nematode population remains low for 3 or more yrs with first applications of DBCP at rates of 5 to 10 gal/A. O'Bannon and Reynolds (4) found that under Arizona conditions, citrus trees retreated every 4 yrs with DBCP (4 gal/A) did not revert to decline caused by the citrus nematode. The nematode population increased slowly after the first treatment and reached damaging population levels after 5 yrs. Previous research in Texas (3) has shown that the citrus nematode recovers from DBCP treatment within 3 yrs.

Fruit yields for the 1972-1973 season (Table 2) showed a significant increase in ring-picked fruit for both treatments, compared to the nontreated plots. Total yields were not significant, although yields from treated plots were higher than those from nontreated plots. Data on yields for the 1973-1974 season were lost, because of an unscheduled harvest. Results from this research showed that yearly applications of DBCP at 1.3 gal/A are more effective in controlling the citrus nematode after 3 yrs than a triennial rate of 4 gal/A. In this test as much as 75% of the first pick graded No. 1 fruit at $75 a ton, and the remainder No. 2 at $37.50 a ton, and the second picking was processed for juice at $28 a ton. Net proceeds from the fruit from trees treated annually and triennially exceeded those from the nontreated plots by $260.84 and $141.67/A respectively. Many growers would prefer annual applications because cost of material can be paid for yearly instead of triennially. Ease of application in irrigation water makes application cost negligible. However, DBCP is presently registered only for use triennially in citrus orchards, and the new use must be registered before DBCP can be used annually.

Table 1. Control of the citrus nematode, as influenced by annual and triennial applications of DBCP.

	DBCP		
Sample date	4 gal/A	1.3 gal/A	Check
7-28-71	16,940[a]	13,460	14,636
10-21-71	0	40	7,855
5-19-72	9	620	20,797
8-10-72	415	3,195	21,886
11-15-72	251	0	2,520
3-12-73	1,613	2	10,660
6- 5 -73	9,045	26	18,573
9-24-73	7,840	417	7,130
12-12-73	35,493	158	25,013
3-11-74	6,400	2	16,322

[a]Citrus nematodes per 100 g soil and 3 g roots.

Table 2. Yield of grapefruit as influenced by control of the citrus nematode with annual and triennial rates of DBCP.

	Yield / 140 trees (75 lb sacks)		
	DBCP		
Harvest date	4 gal/A	1.3 gal/A	Check
12-15-72	334	404	253
1-15-73	191	160	217
Total	525	564	470

RESUMEN

Aplicación anual de DBCP (1,2-dibromo-3-chloropropane) (1.3 gal/A 12.1 CE) a árboles de toronja infectados con el nemátodo cítrico resultó en el control más eficaz del nemátodo que la proporción normal trienal (4 gal/A 12.1 CE). La cosecha de la fruta #1 (un diam de 3-9/16 pulgadas y más grandes) de los dos tratamientos aumentó significadamente comparada con la de los árboles sin tratamiento. Producciones en total, inclusive la fruta para el procesado, no diferieron significadamente.

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NEMATODOS FITOPARASITOS ASOCIADOS AL CULTIVO DE CACAO (*THEOBROMA CACAO* L.) EN VENEZUELA [PLANT-PARASITIC NEMATODES ASSOCIATED WITH CACAO (*THEOBROMA CACAO* L.) IN VENEZUELA]

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RESUMEN

En un reconocimiento para nematodos realizado en plantaciones de cacao (*Theobroma cacao* L.) en Venezuela, se analizaron 128 muestras compuestas de suelo y raíces provenientes de los Estados Aragua, Carabobo, Yaracuy, Miranda y Sucre. Un total de 15 géneros de nematodos fitoparásitos, o géneros que se sospecha que pudieran actuar como tales, fueron encontrados asociados con el cultivo, siendo *Helicotylenchus* el que más frecuentemente se observó. Otros géneros encontrados fueron *Meloidogyne, Paratylenchus, Rotylenchulus, Pratylenchus,*