Response of a Sugarcane Nematode Population to the Addition of Nematocides in Irrigation Water

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INTRODUCTION

The occurrence of large numbers of parasitic nematodes in sugarcane has been associated with poor growth, poor ratooning, and poor germination, and the evidence so far obtained seems to indicate that they play an important role in the yield-decline problem (*1,2,5*).[2] In Puerto Rico extensive samplings of suspected areas have shown the presence of species of *Helicotylenchus*, *Meloidogyne*, *Pratylenchus*, *Tylenchorhynchus*, *Criconemoides*, *Rotylenchulus*, *Hemicriconemoides*, *Hoplolaimus*, *Trophurus*, *Ditylenchus*, *Tylenchus*, *Paratylenchus*, *Belonolaimus*, *Hemicycliophora*, *Criconema*, *Xiphinema*, *Trichodorus*, and *Longidorus*.

Young (*5*) conducted several exploratory tests in which several nematocides were evaluated. He found increases in cane tonnage as high as 10 tons per acre, using D-D at 20 gallons per acre, and 20 tons with Nemagon at 2.5 gallons per acre. He studied also the effects of these nematocides on the nematode population, but did not record its fluctuation in detail.

An experiment was conducted at the Isabela Substation in which Nemagon and Fumazone were applied in irrigation water to sugarcane. The experiment lasted from June 1960 to June 1962. However, the results reported herein are restricted to the data obtained from the plant-crop cane which includes the period from June 1960 to June 1961. Several difficulties were encountered during the second year which made it impossible to carry out the experiment in a well-organized, controlled way.

MATERIALS AND METHODS

The experiment was conducted in a Coto clay with an average soil pH of 5.73, which had been planted to sugarcane for over 10 consecutive years. Examination of soil samples from this area demonstrated that *Helicotylenchus*, *Meloidogyne*, and *Pratylenchus* were the most numerous parasitic nematodes present. Other parasitic nematodes less commonly found in the field were *Ditylenchus*, *Tylenchus*, and *Rotylenchulus*.

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[2] Italic numbers in parentheses refer to Literature Cited, p. 330.

The field was prepared following a balanced incomplete block design. Thirty plots 40 by 50 feet, each one separated by alleys 8 feet wide, were used for the following treatments which were replicated six times: Nemagon ½ gallon per acre, Nemagon 1 gallon, Fumazone ½ gallon, Fumazone 1 gallon, and control, which consisted of an application of water without nematocide.

The field had a common ditch which opened into secondary ditches along each alley. These, in turn, opened into the plot furrows. Each plot consisted of 11 furrows spaced every 5 feet. Forty seed-pieces of P.R. 1013 variety, each with three eyes were planted in each of these furrows.

The first fumigation was made at planting time on June 22, 1960, using a Jaeco Gravity-Flow Fumigating Kit (*4*). This kit was placed to deliver the nematocide into the irrigation ditch at least 100 feet before each treated plot. An average of 20 minutes was needed to irrigate each plot. Soil temperature at an 8-inch depth was 80° F. A second fumigation was made in November 1960, 5 months after planting, using the same rates. Soil temperature at 8 inches depth was 78° F.

Before planting, Aldrin, 25-percent emulsion concentrate, an insecticide for the control of soil insect pests, was applied to the soil at the rate of 2 pounds actual in 100 gallons of water per acre. Simazine 50-percent W.P. at the rate of 5 pounds in 50 gallons of water per acre was applied as preemergence herbicide on June 27, 1960. Fertilizer 12-10-8 at the rate of 1,000 pounds per acre was used.

Soil samples were taken at 3-month intervals, except at time of fumigation when sampling was done immediately before fumigation and 1 month thereafter. Samples were taken from lines 3, 6, and 9 in each plot. Three samples were taken from each line, making a composite sample of nine subsamples. Sampling was always done exactly at the same place, and consisted of taking approximately 150 cc. of soil from about the root rhizosphere at 6- to 8-inch depths. Each composite sample was thoroughly mixed in the laboratory, and 600 cc. of soil was processed for nematode counting using the Baermann-Funnel technique.

RESULTS

The results demonstrated that there was a definite reduction of nematodes after each application of the nematocides in irrigation water. Figure 1 illustrates the fluctuation of the parasitic nematodes present in the sugarcane field where the experiment was conducted.

As shown in figure 1, the population of parasitic nematodes was very much reduced in all treatments 1 month after the first fumigation, which was made on June 22, 1960. The population of the control plots was also slightly reduced by this time. A statistical analysis of the population before

and after fumigation revealed that all treatments were significantly better than the control. However, no significant differences were found between the treatments.

Soil sampling on October 1960, 4 months after fumigation, showed a

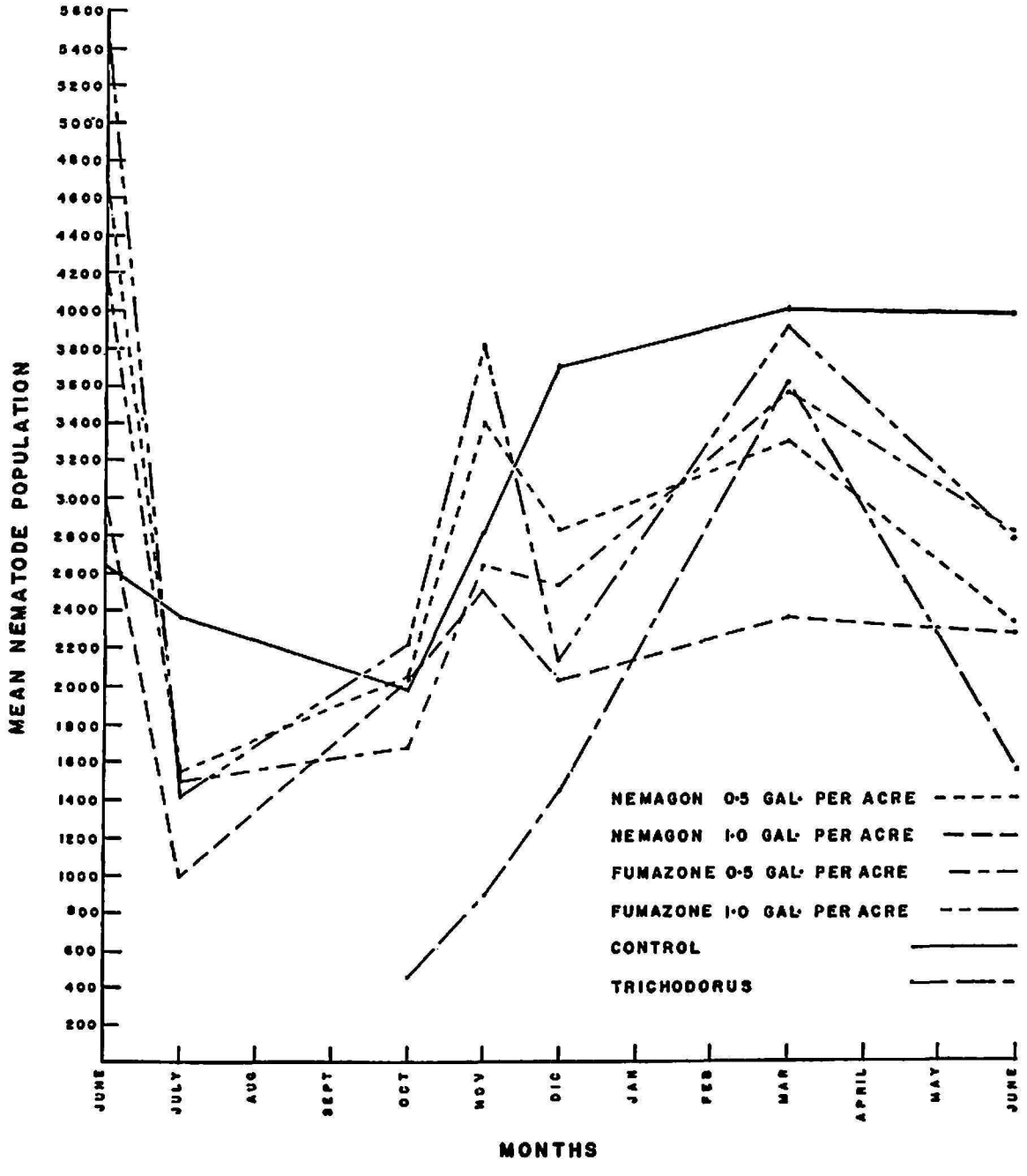

FIG. 1.—Fluctuation of the parasitic nematode population following applications of nematocides in irrigation water for the period of June 1960 to June 1961.

trend towards a gradual increase of the population. In contrast, the nematodes in the control plots had decreased even further.

On November 1960, 5 months after fumigation, a drastic increase of the population was observed in all treatments including the control. A second

fumigation using the same rates was applied this same month, with the purpose of determining whether the population could be kept from reaching the original numbers. As a result, the tendency for a reduction of the nematode population 1 month after fumigation was observed for a second time, but to a lesser degree. The population of the control plots increased.

In March 1961, 4 months after the second fumigation, the situation was somewhat similar to that observed 5 months after the first fumigation. Here again the nematode population in the treated plots was increased. The nematode population in the control plots was further increased by this time.

At harvesttime, 12 months after planting, the nematodes from three treatments: Nemagon ½, Fumazone ½, and Fumazone 1 gallon per acre,

TABLE 1.—*Adjusted means of the data obtained for saccharose percent, tons of cane per acre and hundredweights of sugar per acre, as affected by nematocide treatments of irrigation water*

Treatment	Saccharose	Cane	Sugar
	Percent	*Tons/acre*	*Hundredweights/acre*
Nemagon ½ gal./acre	8.67	52.98	92.41
Nemagon 1 gal./acre	8.93	52.72	94.38
Fumazone ½ gal./acre	8.55	48.88	83.78
Fumazone 1 gal./acre	8.57	50.97	87.41
Control	8.17	48.89	79.48
Average	8.58	50.89	87.49
LSD[1] 0.05	1.28	6.28	19.56

[1] LSD 0.05 = least significant difference at 5-percent level.

were found to have decreased more drastically than the population from the control, and after treatment with Nemagon at 1 gallon per acre. Populations in treated plots were reduced only very slightly.

As illustrated in figure 1 the stubby root nematode, *Trichodorus*, was not detected in soil samples taken before the first fumigation, nor 1 month afterward. However, specimens of *Trichodorus* were found in the third sampling which was made 4 months after the first fumigation (October 1960). Since then, this nematode continued to increase in numbers until March 1961. The next sampling, which was made at harvesttime, revealed that the population of *Trichodorus* had decreased.

Daily rainfall and temperature were also recorded during the duration of the experiment. A thorough check of the data disclosed no correlation with population fluctuation.

Table 1 summarizes the yield data obtained from the experiment. The

trend was towards higher values for saccharose, cane, and sugar in the fumigated plots. However, the differences were not significant.

DISCUSSION

We have no experimental evidence to explain the fluctuations of the nematode population following the initial effectiveness of nematocide treatments. However, it is presumed that such favorable ecological factors as abundant new root growth and reduction of competing biota encourage the rapid buildup of a residual nematode population left after fumigation. This is in line with the results of Perry's work on *Trichodorus* in Florida soils (*3*).

In this experiment *Trichodorus* was also found to increase in numbers after fumigation. However, this nematode was not detected in soil samples until 4 months after fumigation. This nematode might have been living deep into the soil, and presumably moved to the surface after fumigation reduced competition.

Nemagon and Fumazone applied in irrigation water had a tendency to increase the values for sucrose, cane, and sugar, but the differences were not significant. Of course, more research should be conducted. The possibility of varying the nematocide rate and frequency should be investigated, as this may have a bearing in preventing the nematode population buildup after fumigation.

SUMMARY

An experiment was conducted in which two nematocides, Nemagon and Fumazone, were applied to sugarcane in irrigation water. The experiment consisted of five treatments: Nemagon ½, Nemagon 1, Fumazone ½, Fumazone 1 gallon per acre, and control, which consisted of an application of water without nematocide. Two applications were given during the year, the first at planting time, the second 5 months after planting.

It was found that the parasitic-nematode population was reduced after the application of the nematocides and, thereafter, the population was gradually increased. Although there was a trend towards higher values for sucrose, cane, and sugar per acre in the plots treated with nematocides, the differences were not significant when compared with the control.

RESUMEN

Se llevó a cabo un experimento en el cual se aplicaron a la caña de azúcar los nematocidas Nemagon y Fumazone en el agua de riego.

El experimento consistió de 5 tratamientos, a saber: Primero, ½ galón de Nemagon por acre; segundo, 1 galón de Nemagon; tercero, ½ galón de Fumazone; cuarto, 1 galón de Fumazone y quinto, agua de riego sin

nematocidas, a manera de testigo. Se hicieron dos aplicaciones al año: una al efectuarse la siembra y la otra, 5 meses después.

Se observó una disminución poblacional de los nemátodos parasíticos inmediatamente después de aplicarse los nematocidas, a partir de lo cual la población comenzó a aumentar de nuevo gradualmente. Aunque se observó una tendencia hacia el aumento en los rendimientos de la sacarosa, producción de caña y producción total de azúcar por acre en las parcelas tratadas con nematocidas, las diferencias no fueron significativas al compararse con las parcelas usadas como testigos.

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