EFFECT OF TEMPERATURE ON SURVIVAL OF *MELOIDOGYNE INCOGNITA* IN FLOODED AND FALLOW MUCK SOIL

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ABSTRACT

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Infective populations of *Meloidogyne incognita* (Kofoid & White) Chitwood remained high in muck soil after 4 wks of flooding or fallowing at temperatures of 10, 15, 20, 25, and 30°C. After 8 wks, infective populations were still high for temperatures of 10 and 15° C but there was a sharp reduction in infectivity at 20° C and further reductions at 25 and 30° C in both fallowed and flooded soil. After 12 wks, infectivity was only slightly reduced at 10 and 15° C but was again greatly reduced at 20° C and was very low at 25 and 30° C in both fallowed and flooded soil. Infectivity was slightly higher after 8 and 12 wks in soil that had been flooded than in soil that had been fallowed. Growth of cucumbers *(Cucumis sativus* L.) was greatly enhanced by the reduced infectivity of the nematodes in soil held at the higher temperatures.

Additional key words: root knot nematodes, root-knot nematode control, nematode infectivity, cultural control.

RESUMEN

Rhoades, H.L. 1982. Efecto de la temperatura sobre la supervivencia de *Meloidogyne incognita* en suelos turbosos inundados y en barbecho. Nematrópica 12: 33-37.

Poblaciones infectivas de *Meloidogyne incognita* (Kofiod & White) Chitwood se mantuvieron en alto número en un suelo turboso después de cuatro semanas de inundación o en barbecho, a temperaturas de 10, 15, 20, 25, y 30C. Después de ocho semanas las poblaciones infectivas aún se mantuvieron en alto número a temperaturas de 10 y 15C pero se observó una disminución drástica en infectividad a temperaturas de 20C, disminución que continuó a temperaturas de 25C y 30C tanto en suelos inundados como los en barbecho. Después de 12 semanas, sólo se observó una ligera disminución en infectividad en los suelos a temperaturas de 10 y 15C pero se notó nuevamente que ésta estaba muy reducida a temperaturas de 20C y era extremadamente baja en suelos mantenidos a 25C y 30C bajo inundación o en barbecho. El grado de infectividad resultó ser ligeramentas más alto después de ocho y 12 semanas en suelos inundados que en los mantenidos en barbecho. El crecimiento de pepinos (*Cucumis*

sativus L) fué estimulado por la baja en infectividad de los nematodos observada en suelos mantenidos bajo las temperaturas más altas del estudio.
Palabras claves adicionales: nematodos noduladores, combate de nematodos, infectividad de nematodos, prácticas de cultivos.

INTRODUCTION

Considerable attention has been given over a long period of time to the effects of flooding and fallowing of agricultural soils for the control of root-knot nematodes. Bessey (2) concluded that flooding would not eradicate root-knot nematodes but believed it reduced damage and suggested that land should be flooded for at least 25 days. Frandsen (5) indicated that submersion for at least 3 mos would be necessary to make flooding effective. Brown (3) reported that flooding for 4 mos killed root-knot larvae but eggs were viable from 12 to 22½ mos after flooding was terminated. Thames and Stoner (9) suggested that a flooded rice-vegetable rotation might economically control root-knot. They found that celery following rice that had been flooded for 66 days was either free of galling or only slightly galled, whereas it was moderately to severely galled following rice without flooding. Rhoades (8) reported that decline of *Meloidogyne incognita* (Kofoid & White) Chitwood and *M. javanica* (Treub) Chitwood was much faster under both fallow and flooded conditions during summer mos than winter mos in Florida. The rate of decline was essentially the same for the two methods during the summer. Fishler and Winchester (4) and Johnson and Berger (7) reported effective control of root-knot with alternate flooding and drying of soil.

Godfrey (6) and Watson (11) have reported control of root-knot from summer fallowing supplemented by frequent cultivation. In controlled temperature experiments, Bergeson (1) detemined that in soil at 10° C, some *M. incognita* larvae were infective after 12 mos but all were non-infective in 4 mos at 26.7° C. At 26.7° C decline of infectivity was very rapid during the first 2 mos. He attributed this to the increased activity of the larvae and their utilization of food reserves at higher temperatures. Van Gundy et al. (10) found that the body contents of *M. javanica* were depleted rapidly at high temperatures in dry soil. Conversely, body contents were conserved at low temperatures in wet soils.

The purpose of this study was to determine the effect of temperature on the longevity of *M. incognita* in muck soil under both fallow and flooded conditions.

MATERIALS AND METHODS

Cucumber roots heavily galled from *M. incognita* were chopped into small pieces and added to Lauderhill muck soil (4% fiber, 67% organic material) naturally infested with *M. incognita.* The soil was then thoroughly mixed and

placed in 10.9 l jars in a greenhouse for 3 wks to allow partial decomposition of the roots. The soil was thoroughly mixed again and used to fill 454 g plastic cups to 3 cm from the top. Thirty cups were placed in each of 5 controlled temperature rooms (10, 15, 20, 25, and 30°C). Fifteen of the cups were flooded and 15 were kept fallow. Flooded pots were maintained at an average depth of 2½ cm of water above the soil line whereas fallow pots had only enough water added periodically to maintain a moist condition. The first water added to the cups was taken from canals in the muck soil areas from which growers pump water to flood their fields. Distilled water was used for all further applications. At intervals of 4, 8, and 12 wks, 5 replicates of both fallowed and flooded soil were removed from each of the temperature rooms. A small hole was made in the bottom of flooded pots to allow slow drainage. After 48 hr, the soil from each cup was transferred to a 10-cm pot in a greenhouse maintained at a temperature range of 21-33°C and planted with four seeds of 'Poinsett' cucumber (*Cucumis sativus* L.). After plant emergence the seedlings were thinned to two per pot and maintained for a period of 4 wks after which the roots were carefully washed and indexed for root galling. Plant weight data were taken for treatment periods of 8 and 12 wks.

RESULTS AND DISCUSSION

The level of infective nematodes was high at the end of 4 wks in both fallowed and flooded soil (Table 1). After 8 wks, infectivity remained high in both fallowed and flooded soil at 10 and 15°C, but at 20°C there was a sharp reduction in infectivity for both treatments and a further decline at 25 and 30°C. After 12 wks infectivity in both flooded and fallowed soil at 10 and 15°C was only slightly less than at the same temperatures after 4 wks. Again, there was a sharp break in the infectivity level at 20°C and further declines to very low levels of infectivity at 25 and 30°C. Increased plant growth at the lower levels of root galling clearly demonstrated the effect of the nematodes and the efficacy of the treatments.

The results of this experiment are in agreement with the findings of Bergeson (1) and Van Gundy et al. (10) regarding the effects of temperature on the survival of *M. incognita* and *M. javanica*, respectively. It also explains the faster rate of decline of populations of *M. incognita* and *M. javanica* during summer months as compared to winter months for both fallowing and flooding as reported by Rhoades (8). Flooding in this experiment apparently had little or no effect on the rate of survival of *M. incognita* since decline of the infective population was slightly faster under fallow conditions than under flooding. This would indicate that growers could probably control *M. incognita* just as well by fallowing as by flooding their fields. However, it is very difficult to fallow land in Florida with the persistence of weed hosts during the hot, rainy summer months. Also, the many other benefits obtained from flooding (conservation of the soil by slowing subsidence, weed, disease, and insect control, etc.) make it a very desirable practice where it can be utilized economically.

Table 1. Effect of temperature on flooding and fallow for root-knot control in muck soil.

Treatment period	Temp.(C)	Root-knot index[x] Fallow	Root-knot index[x] Flooded	Plant Weight[y] Fallow	Plant Weight[y] Flooded
4 wks	10	4.30	4.20	--	--
4 wks	15	4.60	4.40	--	--
4 wks	20	4.50	4.10	--	--
4 wks	25	4.50	4.30	--	--
4 wks	30	4.50	4.40	--	--
LSD .05		.50	.46		
8 wks	10	4.25	4.38	4.90	4.12
8 wks	15	3.75	4.25	8.12	6.15
8 wks	20	2.62	3.00	12.02	10.40
8 wks	25	2.00	2.75	11.50	10.38
8 wks	30	2.00	2.37	13.22	10.42
LSD .05		.36	.50	2.50	2.06
12 wks	10	4.10	3.90	9.76	11.08
12 wks	15	3.50	3.40	12.82	12.72
12 wks	20	2.00	2.30	14.38	15.40
12 wks	25	1.50	2.10	17.10	14.66
12 wks	30	1.50	1.80	16.38	12.54
LSD .05		.25	.45	2.94	2.20

[x]Based on an index of 1, no galling, to 5, severe galling of cucumber roots.

[y]Average plant weight in grams (fresh weight) per pot.

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