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Nematology Laboratories, Department of Botany, Aligarh Muslim University, Aligarh-202002, India

MANAGEMENT OF *MELOIDOGYNE INCOGNITA* IN TOMATO BY SOME INORGANIC FERTILIZERS

by

M. AKHTAR[1], Z. A. SIDDIQUI and I. MAHMOOD

Summary. Ammonium sulphate, superphosphate, potassium nitrate and gypsum at the concentration of 2 g per kg soil as nitrogen, phosphorus, potassium and calcium fertilizer, respectively, induced a significant increase in plant growth, both in *Meloidogyne incognita* inoculated and uninoculated plants. However, increase in plant growth was greater when these fertilizers were used with nematode inoculated plants. Nitrogen fertilizer resulted in greater reduction in galling and nematode reproduction and greater increase in plant growth. Treatment with phosphorus caused less reduction in nematode multiplication, compared to nitrogen treatment, but more than potassium treatment. Calcium application was least effective in reducing nematode multiplication and improving plant growth.

Yield losses in tomato caused by root-knot nematodes in India range from 40 to 46% (Bhatti and Jain, 1977; Reddy, 1985). Infested plants show, in aerial parts, deficiency symptoms of some important elements (Good, 1968). There has been a tendency to use inorganic fertilizers indiscriminately to overcome deficiency symptoms. It is believed that manipulation of fertilizer dosages may influence nematode development and reproduction (Ismail and Saxena, 1976; Zaki and Bhatti, 1989).

The present study investigated the effect of inorganic fertilizers as sources of nitrogen, phosphorus, potassium and calcium on growth of tomato, *Lycopersicon esculentum* Mill., and reproduction of *Meloidogyne incognita* (Kofoid *et* White) Chitw.

Materials and methods

Seeds of tomato cv. Pusa ruby were surface sterilized with 0.1% mercuric chloride for two minutes and washed three times in distilled water. Seeds were dried for one hour at room temperature and five seeds per pot were sown in 15 cm diameter earthen pots containing 1 kg steam sterilized soil. One week after germination the seedlings were thinned to one per pot. One week later seedlings were inoculated with *M. incognita* and fertilized as shown in Table I.

M. incognita was collected from a tomato field and cultured on eggplant (*Solanum melongena* L.) from a single egg mass. Egg masses were hand picked using sterilized forceps and

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TABLE I - *Effect of inorganic fertilizers on the growth of tomato and reproduction of* Meloidogyne incognita.

Treatment	Plant length		Shoot dry weight		Root dry weight (g)	No. of galls per root system	Nematode population	
	(cm)	% increase over control	(g)	% increase over control			No. of females per root system	No. of eggs + juveniles per root and kg soil
Control	79.7	–	14.6	–	2.17	–	–	–
Nitrogen (N)	96.6	21.2	22.5	54.2	3.45	–	–	–
Phosphorus (P)	92.4	15.9	20.4	39.7	3.16	–	–	–
Potassium (K)	87.4	9.7	18.2	24.9	2.87	–	–	–
Calcium (Ca)	84.6	6.1	17.5	20.1	2.52	–	–	–
M. incognita (Mi)	46.2	–	8.8	–	1.92	245	405	26590
MI + N	71.7	55.2	15.5	75.2	3.04	75	128	9070
MI + P	68.0	47.2	13.8	56.2	2.71	108	231	13890
MI + K	64.0	38.6	12.4	40.7	2.48	125	262	16610
MI + Ca	60.6	31.2	11.9	34.5	2.13	140	286	19600
L.S.D. P 0.05	3.8	–	1.16	–	0.37	16	22	414

placed for hatching on 9 cm diameter sieves of 1 mm pore size which were previously mounted with cross-layered tissue paper. Freshly hatched 2000 second stage juveniles were poured into each pot.

Ammonium sulphate, superphosphate, potassium nitrate and gypsum were used as a source of nitrogen, phosphorus, potassium and calcium, respectively, with potassium nitrate as a source of nitrogen and potassium. Twenty grams of each fertilizer were dissolved separately in 100 ml distilled water and 10 ml of this solution which contained 2 g fertilizer was applied to each pot.

Nematode inoculation and fertilization was performed by removing soil around the roots and pouring the suspension/solution uniformly. There were two sets of pots each having five treatments as indicated in Table I. In one set tomatoes were treated with inorganic fertilizers only while in the other, fertilizers and nematodes were added. Pots were watered as needed. The experiment was discontinued 90 days after nematode inoculation.

Plant height, plant dry weight and number of galls per root were recorded. Nematodes in the soil were extracted by Cobb's sieving and decanting technique followed by Baermann funnel. The number of juveniles, eggs and females in the roots were also assessed. Each root system was cut into small pieces and mixed and 1 g root was comminuted for 45 seconds in a Waring blender to recover nematode eggs, females and juveniles. Data were analysed statistically and least significant differences were calculated at P=0.05.

Results

Parasitism by *M. incognita* caused significant reduction in plant growth compared to uninoculated controls (Table I). Use of the inorganic fertilizers increased plant growth significantly both in plant inoculated or not with *M. incognita*. However, growth response was greater in plants with nematodes than those without. Addition of nitrogen (ammonium sulphate) caused the greatest increase in plant growth followed

by phosphorus (superphosphate) and potassium (potassium nitrate). Calcium (gypsum) application caused the least increase in plant growth compared with the other fertilizers.

The highest nematode densities and galling were observed in plants without addition of fertilizers (Table I). Application of nitrogen caused the greatest reduction in galling and nematodes multiplication. Although phosphorus caused reduction in galling and nematode multiplication it was less than that caused by nitrogen. Potassium also caused reduction in galling and nematode multiplication but it was less than nitrogen/phosphorus. Calcium caused the least reduction in galling and nematode multiplication compared to other inorganic fertilizers used (Table I).

Discussion

Application of fertilizers resulted in improved growth of both nematode inoculated and uninoculated plants. Effect on nematode inoculated plants can be attributed to the nematicidal potential of nitrogenous fertilizers (Rodriguez-Kabana *et al.*, 1981, 1982). In fact ammonical nitrogen has been reported detrimental to nematodes (Rodriguez-Kabana, 1986) and it is generally believed that ammonical nitrogen is more damaging to nematodes than nitrate nitrogen (Badra and Khattab, 1980). This is confirmed by the fact that where ammonium sulphate was used nematode reproduction was greatly reduced. Phosphorus nutrition enhances root growth and expands absorptive capacity of the root system which has been related to increased tolerance to pathogens (Cameron, 1986). Moreover, use of superphosphate reduces soil pH (Pant *et al.*, 1983) which may adversely affect nematode reproduction. Reduced nematode multiplication caused by potassium nitrate was due to combined effect of both potassium and nitrogen. The adverse effect of potassium on nematode reproduction has been reported by Mukhopadhyaya and Prasad (1968) and Gupta and Mukhopadhyaya (1971).

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