

Original Research Article

Efficacy of Fumigants for the Management of Root-Knot Nematode, *Meloidogyne incognita* on Tomato (*Solanum esculentum* Mill.)

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ABSTRACT

Tomato is a day neutral vegetable crop grown throughout the world under tropical and subtropical conditions. Root-Knot Nematode, *Meloidogyne incognita* is widely distributed in India and cause severe damage to tomato. Environmental condition of poly-house is congenial for nematode growth and reproduction, so efficacy of soil fumigants on plant growth characters and reproduction of *M. incognita* on tomato was investigated by using STTC and Metham Sodium. Result showed that Metham Sodium at 40 ml/m² was recorded most effective fumigant over Metham Sodium at 30 ml and STTC 40 ml/m² as compared to control. Metham Sodium at 40 ml/m² reduce nematode reproduction viz. no. of galls/plant, no. of egg masses/plant, no. of eggs & larvae/egg mass and nematode population/200 cc soil and enhance plant growth characters viz. shoot length, root length, shoot weight and root weight. Highest yield was also recorded with Metham Sodium at 40 ml/m² (10.32 kg/plant) over control.

Keywords

STTC, Metham Sodium, *Meloidogyne incognita*, Management, Tomato

Introduction

Tomato (*Solanum esculentum* Mill.) is one of the most important vegetable crop in the world. The major tomato growing countries are China, India, USA, Turkey, Egypt and Italy. India is a second largest producer (12.5 %) of tomato in the world. During 2014-15, in the world tomato was grown in area of 4.86 million hectares with production of 170.8 MT and productivity was 34.01 MT per hectare while in India it is grown in 0.89 million hectare with production 19.16MT and productivity 21.52 MT per hectare. (Anon., 2016).

In India, over 350 plants are known as the host of *Meloidogyne* spp. (Sen and Dasgupta, 1982). *M. incognita* alone

infesting about 250 and *M. javanica* infecting about 150 genera of plants (Krishnappa, 1985). A yield loss of 35-39.7% has been reported due to root-knot nematode infestation (Reddy, 1985 and Jonathan *et al.*, 2001). Bhatti and Jain (1977) estimated the crops losses up to 46.0% in Haryana state only. Reddy (1985) estimated percentage of loss of 39.77 at 20 larvae /g soil in tomato field in Karnataka.

The protected vegetable cultivation technology can be utilized for year round production of high value quality vegetable crops, with high yield and one or more of these factors are controlled such as temperature, CO₂ concentration, relative

humidity, access to insect and pest etc. Growing tomato in poly-houses has increased productivity and yield. Where more incidences of root-knot nematode and soil borne diseases under congenial atmosphere at 20 to 25° C temperature and relative humidity 55 to 85 during august to march for both host and parasite. In these condition root-knot nematode infection increased tremendous by which reduced the production of crop grown in poly-house. Hence there is urgent need to manage root-knot nematode in poly-house for high production of tomato. So far substantial work has been done on various aspects of productive technology for growing tomato under poly-house. However, there is not much information available on the studies on management of root-knot nematode on tomato under protective cultivation. In view of this, the present investigation has been carried out.

Materials and Methods

The experiment was conducted during 2016-17 in the poly-house situated at horticulture farm Rajasthan College of Agriculture, Udaipur, The size of the poly-house in 28 m × 32 m (896 m²) covered with aluminate sheet and stabilized low density polyethylene sheet having 200 micron thickness. The region falls under agro climatic zone IV a (Sub Humid Southern Plain and Aravali Hills) of Rajasthan. It has a typical sub-tropical climate, characterized by mild winters and summers.

The experiment was carried out to test the efficacy of STTC @ 20, 30, 40 ml/m² and Metham Sodium @ 20, 30, 40 ml/m² for the management of root-knot nematode, *Meloidogyne incognita* on Tomato (cv. Dev) as soil fumigation. Untreated check was maintained for the comparison. STTC and Metham Sodium were mixed in soil with

vermicompost at 15 cm depth. After fumigation, the soil was covered with 25 micron transparent polythene film and the edges were sealed. After 15 days polythene sheet was removed and soil was pulverized to let the residual fumes escape. After one week of removing polythene sheet, the tomato seedlings were transplanted.

Results and Discussion

Experiment was conducted to find out the efficacy of two chemical as soil fumigation on plant growth characters and reproduction of *M. incognita* on tomato. In this experiment two chemicals viz. STTC (Sodium Tetra Thio-Carbemate) and Metham Sodium were used @ 20ml, 30ml, 40ml and 20ml, 30ml, 40ml/m² respectively and suitable control was also maintained for comparison. Observations on plant growth characters (shoot and root length, shoot and root weight), nematode reproduction (number of galls per plant, number of egg masses per plant, number of eggs per egg mass, final nematode population/200cc soil) and yield kg/plant were recorded

Experimental findings exhibited that soil fumigants significantly enhanced growth parameters of tomato viz. shoot length & weight, root length & weight and yield and suppressed the nematode reproduction viz. number of galls per plant, number of egg masses per plant, number of eggs per egg mass, final nematode population/200 cc soil. However, the maximum shoot length (209.59 cm), shoot weight (865.00 g), root length (31.12 cm), root weight (34.33 g) and yield (10.32 kg/plant) were recorded with Metham Sodium at 40 ml/m² followed by Metham Sodium at 30 ml/m² (192.13 cm), (830.33g), (25.13 cm) (30.67 g) and (10.03kg/plant) and STTC at 40 ml/m² (180.81 cm), (803.33 g), (24.55 cm), (29.67 g) and (9.76 kg/plant).

Table.1 Effect of fumigants on plant growth parameters of tomato against root-knot nematode, *Meloidogyne incognita* in poly-house

S. No	Treatment	Shoot length (cm)*	Root length (cm)*	Shoot weight (g)*	Root weight (g)*	Yield kg/Plant*
T ₁	STTC@20g/m ²	164.73 (30.16)	12.42 (64.84)	716.67 (17.94)	25.67 (79.07)	8.58 (63.31)
T ₂	STTC @30g/m ²	166.45 (31.52)	14.97 (93.91)	747.33 (22.98)	27.33 (90.70)	9.00 (71.38)
T ₃	STTC @40g/m ²	180.81 (42.87)	24.55 (218.01)	803.33 (32.20)	29.67 (106.98)	9.76 (85.79)
T ₄	Metham Sodium@20ml/m ²	170.88 (35.02)	17.09 (121.37)	782.00 (28.69)	28.00 (95.35)	9.52 (81.28)
T ₅	Metham Sodium@30ml/m ²	192.13 (51.81)	25.13 (225.52)	830.33 (36.64)	30.67 (113.95)	10.03 (90.99)
T ₆	Metham Sodium@40ml/m ²	209.59 (65.61)	31.12 (303.11)	865.00 (42.35)	34.33 (139.53)	10.32 (96.51)
T ₇	Control	126.56	7.72	607.67	14.33	5.25
SEM ±		3.20	0.99	8.53	1.09	0.08
CD 5%		9.71	3.02	25.88	3.31	0.24

Initial Nematode Population 528 larvae/ 200 cc Soil

Data in parenthesis are increased Plant Parameter over Control (%)

Table.2 Effect of fumigants for the management of root-knot nematode, *Meloidogyne incognita* on tomato in poly-house

S. No	Treatment	No. of galls/ Plant**	No. of egg masses/ Plant**	No. of eggs & larvae/ egg mass**	Nematode population/ 200 cc soil**
T ₁	STTC@20g/m ²	88.33 (31.17)	92.33 (38.88)	242.33 (7.27)	975.00 (40.88)
T ₂	STTC @30g/m ²	84.00 (34.55)	87.67 (39.12)	248.67 (4.85)	935.00 (43.29)
T ₃	STTC @40g/m ²	70.67 (44.94)	74.33 (48.38)	243.33 (6.89)	840.00 (49.61)
T ₄	Metham Sodium@20ml/m ²	76.33 (40.52)	80.67 (43.98)	245.67 (5.99)	897.00 (45.59)
T ₅	Metham Sodium@30ml/m ²	63.67 (50.39)	67.00 (53.74)	242.00 (7.40)	814.00 (50.65)
T ₆	Metham Sodium@40ml/m ²	57.67 (55.06)	62.00 (56.94)	236.33 (9.57)	775.00 (52.97)
T ₇	Control	128.33	144.00	261.33	1649.00
SEM ±		2.00	1.89	1.12	10.11
CD 5%		6.07	5.74	3.41	30.68

Initial Nematode Population 528 larvae/ 200 cc Soil

Data in parenthesis are reduction of Nematode Reproduction over Control (%)

While minimum 57.67 galls per plant, 62.00 egg masses per plant, 236.33 eggs and larvae per egg mass and 775.00 nematode population per 200cc soil were observed with Metham Sodium at 40ml/m² followed by 63.67, 67.00, 242.00 and 814.00, respectively with Metham Sodium at 30ml/m² and 70.67, 74.33, 243.33 and 840.00, respectively with STTC at 40g/m².

These findings are in agreement to the findings of Patel *et al.*, (2017) also where that Dazomet @ 15 and 20 g/m², Metham Sodium and STTC each @ 5 and 10ml/m² in combination with soil solarization gave maximum seedling growth and production of transplantable seedlings and significantly reduced root-knot disease as compared to fumigation alone. Chandel *et al.*, (2014) also reported Metham Sodium alone and in combination with neem cake enriched with bio-agents *Purpureocillium lilacinum* and *Pseudomonas fluorescens* has been most effective against root-knot nematode infecting tomato, capsicum and carnation. Annual Report IARI (2011) combined treatment of FYM and fumigants significantly reduced root gall index caused by *Meloidogyne incognita*. Treatment with Metham Sodium gave significant results where in the gall index was reduced significantly at 2.27 compared to 4.93 in control. The 52 final nematode population was the least in the treatment of Metham Sodium + FYM at 1.17/cm³ soil compared to 4.77/cm³ soil in control. Oloo *et al.*, (2009) also reported that, Metham Sodium and Dozamet still remain the most effective means of controlling nematodes under enclosed environment.

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