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Management of Root-Knot Nematodes (*Meloidogyne* spp.) using different Chemicals in Tomato Nursery

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A B S T R A C T

A nursery experiment conducted to study the efficacy of different chemicals for the management of *Meloidogyne* spp. in tomato nursery indicated that soil application of Dazomet @ 300 kg per ha followed by Phorate @ 3 kg per ha proved effective in improving the seedling growth parameters, number of transplantable seedlings and reduce root-knot disease and final nematode population.

Introduction

Tomato (*Solanum lycopersicum* L.), the most prize and popular *solanaceous* vegetable crop universally known as protective food is being extensively grown all over the world. In India, tomato is cultivated under the area of 8, 01,000 ha with production of 22337 thousand MT (Anon., 2017a). Osei *et al.,* (2012) reported *Helicotylenchus* spp., *Hoplolaimus indicus*, *Meloidogyne incognita*, *Pratylenchus brachyurus*, *Rotylenculus reniformis*, *Scutellonema* spp., *Tylenchulus* spp. and *Xiphinema elongatum* from tomato. Tomato is often severely attacked by root-knot nematode, *Meloidogyne* spp. a predominant and widely prevalent species inflicting serious loss in tomato (Sasser, 1989; Reddy, 1986; Bhatti and Jain, 1977; Kamran *et al.*, 2011; Grace *et al.*, 2009; Cetintas and Yarba, 2010).

Forty per cent yield losses in tomato due to *M. incognita*, was reported by Singh and Kumar (2015). Various centers of 'All India Co-ordinated Research Project on Nematodes in Agriculture' estimated yield losses in different cultivars of tomato which ranged between 5 – 37 per cent (Anon, 2017b). Therefore, present investigation was carried out to manage root-knot disease in tomato nursery.

Materials and Methods

The present investigation was carried out in root- knot (mix population of *M. incognita* and *M. javanica*) nematode sick nursery of Department of Nematology, B. A. College of Agriculture, AAU, Anand during *kharif* 2016-17. There were total six treatments and four replication in randomized block design. (T_1: Carbosulfan @ 2.5 l/ha, T_2: Cartap hydrochloride @ 3 kg/ha, T_3: Carbofuran @ 3 kg /ha, T_4: Phorate @ 3 kg /ha, T_5: Dazomet @ 300 kg /ha and T_6: Control (Untreated check). In nursery, 1.2 x 1.2 m sized 24 nursery beds were prepared. Granular formulations of Cartap hydrochloride, Carbofuran and Phorate were broadcasted in the respective beds and mixed in the soil before seeding. Carbosulfan 0.05 per cent was applied as a soil drenching one day prior seeding. Dazomet was broadcasted @ 30.6 g/m^2 and mixed in the soil. Soil was compressed and moisture was maintained by applying water with water cane for 15 days. Soil sample was collected from the nursery area and processed by Petridish Assembly Method (Chawla and Prasad, 1974) in laboratory to estimate initial root-knot nematode population in the nursery. Seeds of tomato variety Gujarat Tomato-2 were broadcasted in prepared beds @ 3 g/bed. Bed without any chemical application was kept as an untreated check. Germination count per 225 cm^2 was recorded at four different spot in each bed. Number of transplanted seedlings was recorded at 1st and 2nd pulling. After 5 weeks of sowing, the experiment was discontinued by removing the seedlings from the nursery and roots were washed gently under running tap water. Observations on seedling height, weight and root-knot index (0-5 scale) were recorded at the time of 1st pulling. Roots were cut in to 2-3 cm length and 3g roots were stained in 0.05 per cent acid fuchsin in lactophenol. Then roots were washed with tap water to remove excess stain and kept overnight in lactophenol for destaining. Then the roots were examined for nematode population. At the time of termination of experiment final nematode population per 200 cm^3 soil recorded.

Results and Discussion

Initial root-knot nematode population was 210 J_2 per 200 cm^3 of soil in nursery. Germination count was maximum (17.15) in the treatment of soil application of dazomet (T_5) and it differed significantly with rest of the treatments. Results obtained in the treatment of carbosulfan **(**T_1), carbofuran (T_3), phorate (T_4) and control (T_6) was statistically at par with each other. Germination count was minimum (6.50) in cartap hydrochloride (T_2)**.** It may be due to toxic effect of cartap hydrochloride on seed germination (Table 1). Babu and Umarjan (2015) also observed that significant inhibition in germination and shoot-root growth due to toxic effect of cartap hydrochloride in barley. Significantly highest number of transplantable seedlings *i.e.* 271.50 was found in dazomet (T_5) treatment. Next best treatment was phorate (T_4) which did not differ significantly with the treatment of carbosulfan (T_1), carbofuran (T_3) and control (T_6). Lowest number of transplantable seedlings was noticed in the treatment of cartap hydrochloride (T_2) at 1st and 2nd pulling (Table 1). Seedlings raised in the beds treated with dazomet have maximum seedling height (22.6) and stastically differed with rest of the treatments. Next effective treatment was phorate (T_4) which remained at par with carbofuran (T_3) and carbosulfan (T_1). Seedling height was lowest in the control (T_6). However, it was statistically at par with cartap hydrochloride (T_2) (Table 1). Maximum Fresh shoot weight (82.92) was recorded for the seedlings raised in the beds treated with dazomet (T_5) and it significantly differed from rest of the treatments. Phorate (T_4) was second highest. Treatment of cartap hydrochloride

(T_2) had lowest shoot weight and it remained at par with control (T_6), carbosulfan (T_1) and carbofuran (T_3) (Table 1). Maximum fresh root weight (7.03) was registered in dazomet (T_5) followed by phorate (6.03) (T_4), control (6.66) (T_6), carbofuran (6.07) (T_3) and carbosulfan (5.63) (T_1). They were statistically at par with each other. It was minimum in cartap hydrochloride (4.11) (T_2) followed by carbosulfan (5.63) (T_1) was statistically at par with each other (Table 1).

Table.1 Effect of different chemicals on plant growth characters of tomato

Treatment	Germination count/225 cm^2	Seedling height, cm	Fresh weight, g		Transplantable seedlings/bed (1.44 m^2)		
			Shoot	Root	1st pulling	2nd pulling	Total
T_1 (CAS)	12.75	15.7	46.00	5.63	143.75	44.00	187.75 (6.07)*
T_2 (CH)	6.50	12.9	42.57	4.12	24.25	8.50	32.75 (-81.50)
T_3 (CAR)	13.00	16.3	54.50	6.08	137.25	45.00	182.25 (2.97)
T_4 (PHO)	13.50	18.4	65.62	6.70	155.25	46.75	202.00 (14.12)
T_5 (DAZ)	17.15	22.6	82.92	7.03	271.50	75.00	346.50 (95.76)
T_6 (CON)	12.60	12.5	42.96	6.66	135.25	41.75	177.00
SEm ±	0.91	1.0	5.13	0.51	7.35	1.76	--
CD (0.05)	2.67	3.0	15.46	1.53	21.49	5.15	--
CV %	14.52	12.3	18.40	16.83	10.16	8.10	--

*per cent increase/decrease over control

Table.2 Effect of different chemicals on multiplication of *Meloidogyne* spp. on tomato

Treatment	RKI (0-5)*	Nematode population		
		No. of females/3 g root	No. of juveniles/200 cm^3 soil	Total
T_1 (CAS)	2.35(30.47)**	2.31 (203)	2.80 (630)	2.93 (850)
T_2 (CH)	2.50 (26.03)	2.37 (233)	2.86 (723)	2.99 (976)
T_3 (CAR)	2.40(29.00)	2.35 (223)	2.81 (645)	2.95 (890)
T_4 (PHO)	1.30 (61.54)	2.13 (134)	2.63 (426)	2.76 (574)
T_5 (DAZ)	0.24 (92.90)	1.40 (24)	2.22 (165)	2.29 (194)
T_6 (CON)	3.38	2.61 (406)	3.12 (1317)	3.24 (1737)
SEm ±	0.15	0.06	0.08	0.07
CD (0.05)	0.43	0.17	0.24	0.19
CV %	14.65	5.17	6.11	4.62

*0 = Free; 5 = Maximum disease intensity. Figures in parentheses are retransformed values of Log X+1, ** per cent reduction over control.

Root-knot index was significantly less (0.24) in the treatment of dazomet (T_5) as compared to rest of the treatment. Treatment of phorate (T_4) was second best treatment and significantly differed with remaining treatments except dazomet (T_5). Control (T_6)

has maximum root-knot index which significantly differ with carbosulfan (T_1), cartap hydrochloride (T_2) and carbofuran (T_3) (Table 2). Significantly less number of female (1.40) were recorded in the dazomet (T_5) treatment followed by phorate (T_4). Control (T_6) had maximum number of females. Nematode population, J_2 in soil was also lowest in dazomet (T_5) and differed significantly with other treatments including control (T_6). Control (T_6) had maximum (3.12) juveniles/200 cm^3 of soil. Total nematode population was significantly lower (2.29) in dazomet treatment (T_5) as compared to rest of the treatments. Phorate (T_4) was next to dazomet but stastically non significant with carbosulfan (T_1) and carbofuran (T_3). Total nematode population was significantly higher in Control (T_6). Overall results showed that dazomet is most effective in reducing nematode population and root-knot nematode index and thereby increase plant growth and reduced nematode population followed by phorate and carbofuran (Table 2). Results obtained in this study are also conforming results of Patel and Patel (2009), Anon. (2014), Dhillon and Kaur (2016) and Nie *et al.,* (2016).

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