MANAGEMENT OF RENIFORM NEMATODE, *ROTYLENCHULUS RENIFORMIS* BY SOIL APPLICATION WITH BIOAGENTS ON COWPEA

JAYDEEP PATIL, M. K. SHARMA

Abstract: A screen house study was undertaken to see the efficacy of bioagents as soil application against reniform nematode, Rotylenchulus reniformis infesting cowpea. The experiment was laid in pot filled with infested soil carried from the pure culture field. Soil application of bioagents such as Trichoderma viride, Trichoderma harzianum and Pseudomonas fluorescens were added in soil @1 and 2g / kg soil as soil application along with chemical (carbofuran 3G @ 1kg a.i./ha) and untreated control. The results indicated that the growth parameters of cowpea plants were higher and reniform nematode (R. reniformis) population were reduced in all treatments when compared to inoculated control

Key words: R. reniformis, bio-agents, Vigna unguiculata.

Introduction: Cowpea (*Vigna unguiculata* L.) is one of the important Kharif pulse crop grown in India. It is a warm season crop, well adapted to any areas of the humid tropics and subtropical zones. Cowpea is tolerant to heat and dry conditions, but is intolerant to frost. Cowpea occupying the important place in pulse crops mainly grown in Sikar, Jhunjhunu, Nagaur, Ajmer, Churu, Pali, Sirohi, Dausa, Bhilwara and Udaipur districts of Rajasthan and cultivated in 1.22 lakh ha with production of 64.36 thousand tonnes and average productivity being 529 kg/ha during 2010-11 (Rajasthan Agricultural Statistics at Glance for year 2010-11).

The reniform nematode attacks over 140 species of more than 115 plant genera in 46 families (Jatala, 1991). It has been reported to cause 14.9, 8.1, 6.0, **13.2** and 8.7 per cent loss in yield of cotton, maize, finger millet, cowpea, and black gram respectively (E.I. jonathan, 2001) and also cause losses up to 19 per cent in okra, 20 per cent in tomato, 52 per cent in lettuce, 49 per cent losses in pointed guard and 38.8 per cent in brinjal (Palaniswamy and Balasubramaniam, 1981).

To manage the nematode chemicals proved effective but due to their hazardous effects and non judicious use have enhanced the development of biological control strategies for integrated management of plant parasitic nematodes with various types of antagonistic organisms (Jatala, 1986)

Materials and methods: The experiments were carried out to test the effectiveness of different bio-agents on reniform nematode. Pot experiments were conducted during Kharif season at department of Nematology, Rajasthan college of Agriculture, Udaipur which is situated 579.5 meter above the MSL, soil is clay to clay loam, the average soil pH being 8.2 and minimum and maximum temperature ranges between 22^{o} C. Eight treatments namely, *T. viride, T. harzianum* and *P. fluorescens* (@ 1g and 2g kg soil) as soil application treatment with chemical (Carbofuran 3G @ 1kg a.i. / ha) and untreated control were planned (Table 1). The experiment was conducted in completely randomized block design having four replication in earthen clay pots of 6 " size filled with reniform nematode infested soil (3 larvae/g of soil) carried from the pure culture field. Earthen pots were washed, clean and disinfected before use by rinsing theme through four percent formalin solution. Talc based formulation *T. viride, T. harzianum* and *P. fluorescens* (@ 2g/ kg soil) added to soil each treatment was replicated four times. Three cowpea seeds were sown in each pot. After 10 days of germination one healthy plant in each pot was maintained and others were uprooted carefully. The pots were watered regularly as and when required. Untreated and chemical check (Carbofuran 3G @ 1 kg a.i. / ha) was also maintained for comparison. Plants were harvested after 45 days of sowing.

Observations on plant parameters (shoot and root length, shoot and root weight) were taken at harvest. The roots were washed carefully under tap water and stained with 0.1 per cent acid fuchsin and after wash kept in clear lacto phenol for 24 hrs. Thereafter the roots were examined thoroughly under a stereoscopic binocular microxscope for counting nematode parameters (number of female / plant, number of egg mass / plant, number of eggs and larvae / egg mass, number of females / 5g root weight, population / 200cc soil and total population). After removing the plant from the pot, soil was thoroughly mixed and 200cc soil from each pot were taken and processed by Cobb´s sieving and decanting technique followed by Baermann´s funnel technique for estimation of nematode population in soil.

Result and Discussion: Talc-based formulation of bio-agents *T. viride, T. harzianum* and *P. fluorescens* were used as soil application @ 1g and 2 g/kg soil of each in order to find out the suitable dose for the management of reniform nematode infecting cowpea. Data showed that different bio-agents were significantly effective in improving the plant growth characters to a varied degree and in reducing the nematode reproduction over the untreated check.

Improvement in plant growth characters and reduction of nematode reproduction were directly proportionate to applied doses of bio-agents. However, among these bio-agents, *T. harzianum* was found the most effective as compared to *T. viride* and *P. fluorescens* in improving plant growth characters and reduction of nematode reproduction. (Table 1).

Among doses, *T. harzianum* @ 2 g/kg soil found superior over *T. harzianum* @ 1 g/kg soil. Further it has also been reported that among bio-agent and dose interactions, *T. harzianum* @ 2 g/kg soil and *T. viride* @ 2 g/kg soil were found the best treatment over other bio-agent treatments.

These findings are in agreement with the results of Bari *et al*. (2004) who reported that *T. harzianum* @ 1 g/plant reduced root-knot nematode population and enhancing vegetative growth of lady's finger in the field.

Pandey (2005) reported that *T. harzianum* as soil application significantly enhanced crop yield of menthol mint (*Mentha arvensis*) cv. Kosi. and reduced the nematode populations and root-knot indices.

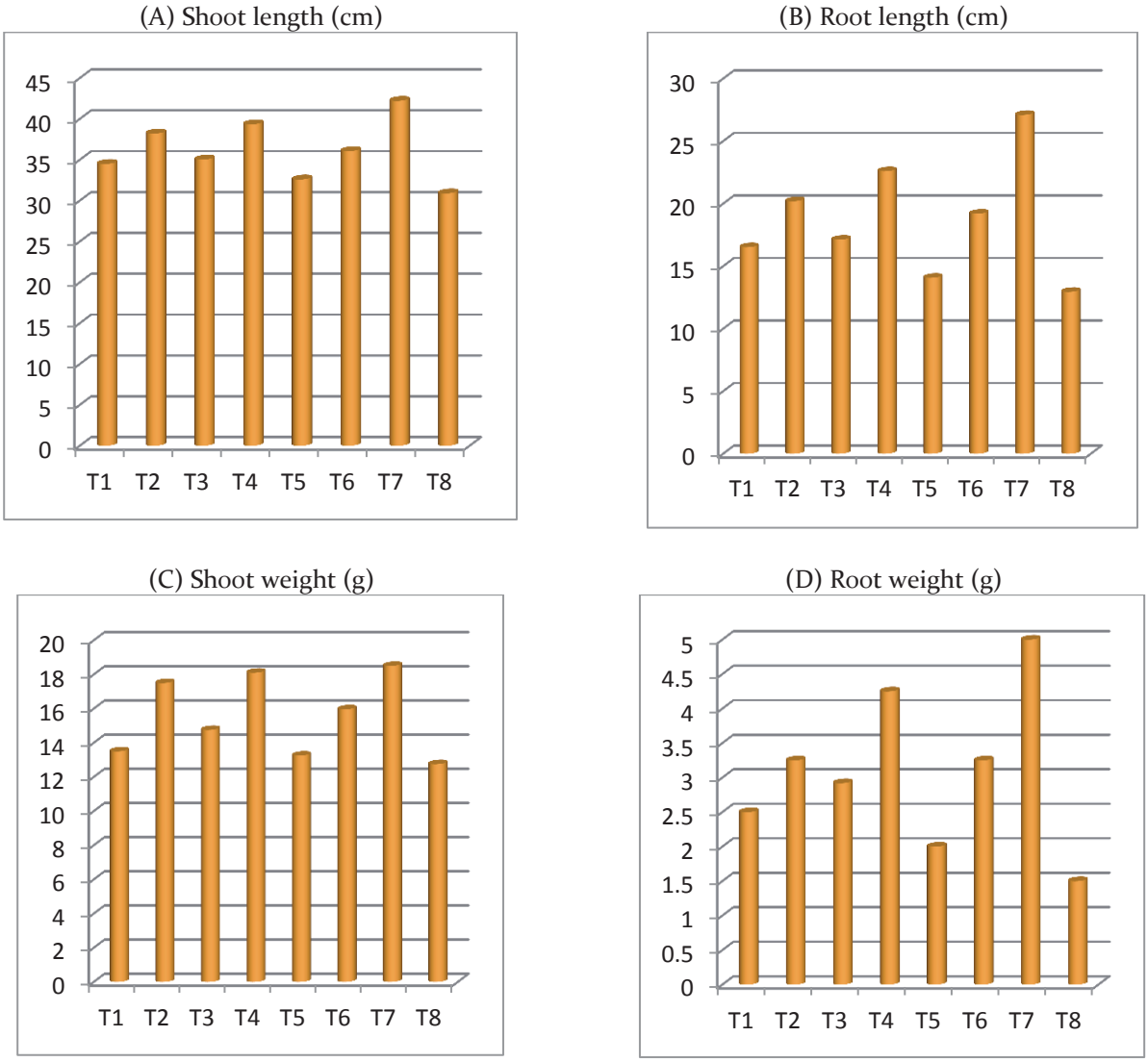
In the present investigation among dose, 2 g/kg soil for each bio-agent was found most effective in reducing nematode reproduction over 1g /kg soil. These finding are in agreement with Barua and Bora (2008) who reported significant increased the plant growth and reduction in final nematode population when treated with *T. harzianum* and *P. fluorescens* at higher level.

Table 1: Efficacy of *Trichoderma viride, Trichoderma harzianum & Pseudomonas fluorescens* at two different doses as soil application against reniform nematode, *R. reniformis* infecting cowpea under pot experiment. (Average of four replication)

Treatments		**Plant Growth Characters**				**Nematode Reproduction**					**Rf FNP / INP**
		Shoot length (cm)	**Root length (cm)**	**Shoot weight (g)**	**Root weight (g)**	**No. of females plant^{-1}**	**No. of egg masses plant^{-1}**	**No. of eggs & larvae egg mass^{-1}**	**Larval population in 200 cc soil**	**Total Nematode Population**	
Trichoderma viride @ 1g/kg soil	T_1	34.50	16.52	13.50	2.50	21.25	18.25	138.00	244.00	3151	1.05
Trichoderma viride @ 2g/kg soil	T_2	38.22	20.20	17.50	3.25	16.25	14.50	122.00	216.00	2325	0.77
Trichoderma harzianum @1g/kg soil	T_3	35.04	17.12	14.75	2.92	18.75	16.50	134.00	232.00	2809	0.93
Trichoderma harzianum @2g/kg soil	T_4	39.35	22.60	18.10	4.25	14.75	13.25	120.00	210.00	2132	0.71
Pseudomonas fluorescens @1g/kg soil	T_5	32.60	14.075	13.25	2.00	24.25	19.50	142.25	256.00	3439	1.14
Pseudomonas fluorescens @ 2g/kg soil	T_6	36.07	19.20	15.96	3.25	17.25	15.50	124.25	220.00	2491	0.83

Chemical check (Carbofuran 3G @ 1kg a.i. /ha)	T_7	42.22	27.10	18.50	5.00	4.00	2.00	18.50	40.50	143	0.04
Untreated check	T_8	30.90	12.95	12.75	1.50	44.00	30.50	166.00	728.00	6928	2.30
SEm+		1.2477	0.9229	1.0771	0.3831	1.0345	0.7756	1.3607	3.3934	113.08	-
D at 5%		4.17	3.08	3.60	1.28	3.45	2.59	4.55	11.34	339.03	-

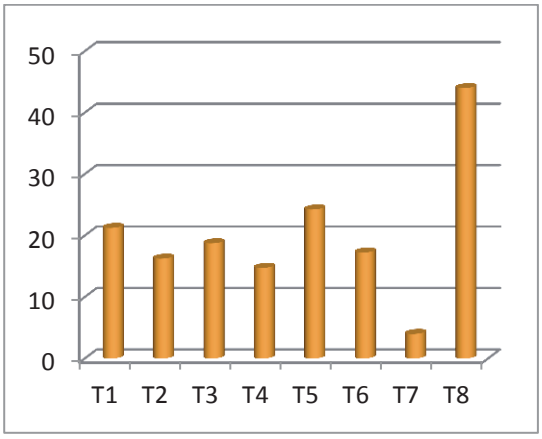
Note: Initial inoculum level: 3 larvae /g soil.

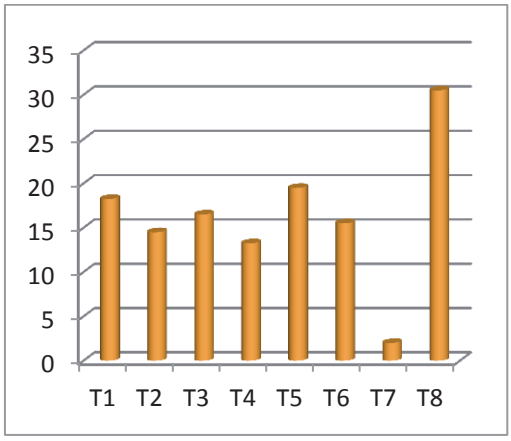


(a) Plant Growth Character

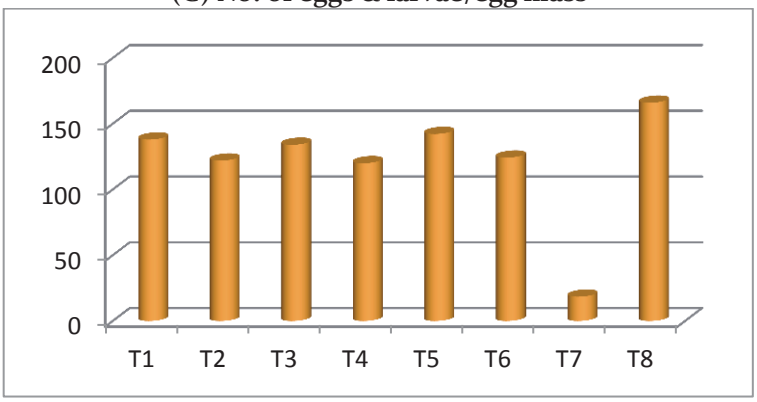
Fig. 2.1: Efficacy of *Trichoderma viride, Trichoderma harzianum & Pseudomonas fluorescens* at two different doses as soil application against reniform nematode, *R. reniformis* infecting cowpea under pot experiment.

(E) No. of females/plant **(F) No. of egg masses/plant**

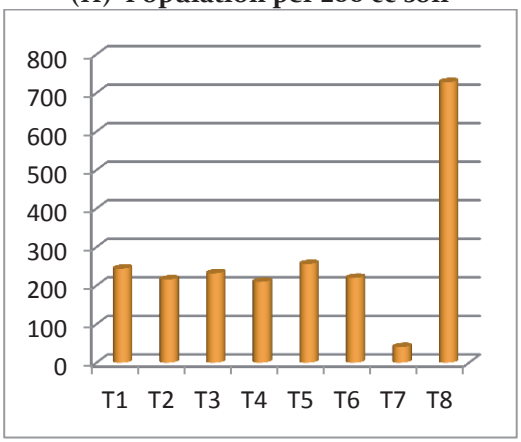




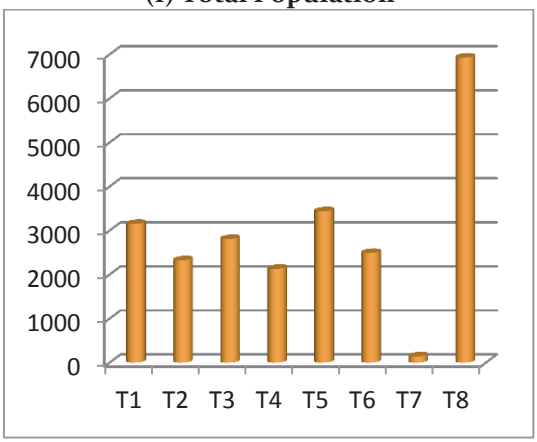
(G) No. of eggs & larvae/egg mass



(H) Population per 200 cc soil



(I) Total Population



(b) Nematode Reproduction

Fig. 2.2: Efficacy of *Trichoderma viride, Trichoderma harzianum & Pseudomonas fluorescens* at two different doses as soil application against reniform nematode, *R. reniformis* infecting cowpea under pot experiment.

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Jaydeep Patil/ M. K. Sharma/
Department of Nematology/ Rajasthan College of Agriculture/ Udaipur-313001/ India/