FIELD EVALUATION OF SOME BIOFORMULATIONS FOR MANAGEMENT OF ROOT-KNOT NEMATODE, *Meloidogyne incognita* INFECTING TUBEROSE

Abstract

Aims: To evaluate the effectiveness of different bioformulations for management of root-knot nematode, *Meloidogyne incognita* infecting tuberose under field condition.
Study Design: Randomized Block Design.
Place and Duration of Study: Biswanath College of Agriculture, Biswanath Chariali, Assam during summer season 2024.
Methodology: Bulbs of tuberose cultivar Prajwal were planted in root-knot nematode infested sick plot. In this experiment seven treatments were considered and the treatments were replicated thrice. All the bioformulations were applied treatment wise and mixed with soil before planting of bulbs. Observations on plant height and floral characteristics *viz.* spike length, rachis length, spike weight, number of floret per spike, floret length and nematode multiplication parameters like number of galls, egg masses per root system and final nematode population in soil were recorded.
Results: Upon observation results showed that all the treatments were significantly effective in increasing the plant height, floral characteristic and reducing the number of galls, eggmasses and final nematode population in soil as compared to that of untreated control. Highest plant height(46.50cm), spike length (66.33cm), spike weight (37.33), rachis length(32cm), number of florets per spike(25.26) and floret length(4.66cm) was recorded in the treatment with Biover@5kg enriched with FYM 5t/ha, which was followed by the treatment with Biozium @5kg enriched with FYM 5t/ha and neem cake @ 1t/ha. Maximum reduction of number of galls (35.18%), eggmasses(31.79%) and final nematode population in soil (39.65%) was recorded in the treatment with Biover@5kg enriched with FYM 5t/ha.
Conclusion: From this experiment it can be concluded that all the bioformulations were found to be effective for increasing plant height, floral characteristic and reducing the nematode multiplication and these can be incorporated in root-knot nematode management progrmme. Among the bioformulations Bioveer was found to be most effective

Key words: Bioformulation, root-knot nematode, Meloidogyne incognita, tuberose

INTRODUCTION

Tuberose, *Agave amica* (Medik.) Thiede & Govaerts (Synonym *Polianthes tuberose* L.) is one of the most important bulbous ornamental plants, perennial in nature, belongs to the family Asparagaceae and sub-family Agavoideae. It is mainly cultivated for fragrant flowers; loose flowers used as garlands, floral decorations, extraction of tuberose oil and spikes as cut-flowers. In India tuberose is commercially cultivated in an area of about 21,970 ha, with a loose

flower production of 1, 21,860 metrictonnes and cut flower production of 93,680 metric tonnes [1]. Among the states of India, tuberose is mainly cultivated in West Bengal, Karnataka, Tamil Nadu, Maharashtra, Orissa, Assam and Uttar Pradesh. Tuberose is very much prone to attack by several pests and diseases. Plant parasitic nematodes are considered as one of the important production constraints of tuberose cultivation. Among the plant parasitic nematodes, mostly three nematodes *viz*., root-knot nematode (*Meloidogyne* spp.), reniform nematode (*Rotylenchulus reniformis*) and foliar nematode (*Aphelenchoides besseyi*) are found to be pathogenic to tuberose cultivation [2,3]. Root-knot nematode, *Meloidogyne incognita* has been considered as one of the limiting factor for commercial cultivation of tuberose [4]; which is responsible to cause 10-14% reduction in flower number and spike weight [5]. Problems of root-knot nematode infestation in tuberose are widespread in most of tuberose growing fields of North and South Indian states [6]. Root-knot nematode infested plant show characteristic symptoms *viz*., production of heavy root galling, general stunting and chlorosis of leaves [7,8]. The infestation of root-knot nematodes makes the tuberose plants more susceptible to attack by *Fusarium oxysporum* f.sp. *dianthi* [9] .Nematodes also predispose the roots to easy entry of other soil borne fungal pathogens and the resulting nematode disease complex is responsible for drastic reduction in yield and financial loss to the growers.

Fig.1 Galls on the roots of Tuberose

MATERIALS AND METHODS

The experiment was conducted during April-September, 2024 in a naturally infested field with root-knot nematode, *M. incognita* at Biswanath College of Agriculture [26.7° (26°42') N

latitude, 93.5° (93°30') E longitude and altitude of 105m AMSL], AAU, Biswanath Chariali, Assam to evaluate the effectiveness of some bioformultions against root-knot nematode infecting tuberose. The different treatments were: T_1: Neem cake@1t/ha, T_2: Biozium (*Trichoderma harzianum*) @5kg enriched with FYM 5t/ha, T_3: Biover (*Trichoderma viride*)@5kg enriched with FYM 5t/ha, T_4: Biomonas (*Pseudomonas fluorescens*) @5kg enriched with FYM 5t/ha, T_5: AAU-Bioguard (*Bacillus subtilis*) @5kg enriched with FYM 5t/ha, T_6: Neem leaf powder@5g/plant, T_7: Untreated control. The experiment was laid out in 1m x 1.2m plots following RBD and treatment was replicated thrice. Initial nematode population on the field was recorded before experimentation ($240J_2$/200cc of soil). Land was thoroughly prepared by harrowing and laddering; plots were laid out as per the design of experiment. Each plot was separated from each other by 0.5m wide space. Bulbs of tuberose (var. Prajwal) were planted in each plot at a spacing of 30 cm from row to row and 30cm from plant to plant. All the bioformulations were applied treatment wise and mixed with soil before planting of bulbs. All other recommended practices were followed as per package of the crop.

Observations on plant height and floral characteristics *viz.* spike length, rachis length, spike weight, number of floret per spike, floret length and nematode multiplication parameters like number of galls, egg masses per root system and final nematode population in soil were recorded. From each plot randomly six plants were selected for recording the plant height and different floral characters and average were taken. For recording number of galls and eggmasses, from each plot six plants were uprooted randomly and numbers were calculated then average was taken. For estimation of population of *M. incognita*, soil samples consisting 10 cores were collected during the time of uprooting at a depth of 15-20cm from each plot using khurpi. Cores were composited and 200cc soil was used for nematode extraction by modified Cobb's sieving and decanting technique. After extraction nematodes were counted in a counting dish using stereoscopic binocular microscope Data were analyzed statistically using analysis of variance and Fisher's least significant difference (FLSD) were calculated for separation of mean.

RESULTS AND DISCUSSION

Data presented in Table1 indicated that all the treatments were found to be significantly effective in increasing the plant height and floral characters *viz*. spike length, spike weight, rachis

length, number of florets per spike, floret length etc. as compared to that of untreated control. Highest plant height(46.50cm), spike length (66.33cm), spike weight (37.33), rachis length(32cm), number of florets per spike(25.26) and floret length(4.66cm) was recorded in the treatment with Biover@5kg enriched with FYM 5t/ha, which was followed by the treatment with Biozium @5kg enriched with FYM 5t/ha and neem cake @ 1t/ha. Lowest plant height and floral characteristic were recorded in untreated control. This might be due to soil application of bioformulations which increases the height of plant as well as floral characteristic. The influence of nematode infection probably caused reduction in plant height and floral characteristics. This finding was in conformity with the findings mad by Saha and Khan [10] in the evaluation of bioformulations for management of root-knot nematode infecting tuberose. They reported that boformulations of *Paecilomyces lilacinus, T. harzianum, P. fluorescens, Pochonia chlamydosporia* and neem cake were effective for reduction of root-knot nematode infestation, nematode population and enhancement of cut flower yield of tuberose. In the present study maximum plant height and floral characteristic was found in the treatments receiving Biover is because of it is more rhizospheric competent and have their direct influence on either plant's growth or induction of plant defensive activity against pathogens [11, 12]. Application of *Trichoderma* spp found to improve the plant growth parameters through enzymatic activities in the treated *Lycopersicon* spp. which ultimately reduced the biotic potentiality of *M. incognita* [13]

Results presented in Table 2 indicated that all the treatments were significantly effective in reducing the number of galls, eggmasses and final nematode population in soil as compared to that of untreated control. Maximum reduction of number of galls(35.18%), eggmasses(31.79%) and final nematode population in soil (39.65%) was recorded in the treatment with Biover@5kg enriched with FYM 5t/ha, which was followed by the treatment with Biozium @5kg enriched with FYM 5t/ha and neem cake @ 1t/ha. Similar results were also obtained by Abhi *et al.*[14} due to application of *T. viride* @10g/kg seed followed by soil application. The antagonistic effect of *T. viride* might be due to several actions, such as mycoparasitism, spatial and nutrient competition, induced systemic resistance, antibiosis by enzymes and secondary metabolites [15]. Annapurna *et al.*[16] also reported that soil application of *T. harzianum* induce defence-related enzymatic activity like peroxidase (PO), polyphenol oxidase (PPO), phenylalanine ammonia lyase (PAL)

and total phenol content in tomato against *M. incognita* and as a result improved the plant growth parameters

Fig.2 View of the Experiment

Table 1. Effect of some bio-formulations on plant growth and floral characteristics of tuberose infested by *Meloidogyne incognita* Mean of 3 replications

Treatments	Plant height (cm)	Spike length (cm)	Spike weight (g)	Rachis length (cm)	Number of florets /spike	Floret length (cm)
T_1: Neem cake @1t/ha	45.73	64.86	35.33	29.73	23.33	3.90
T_2: Biozium @5kg enriched with FYM 5t/ha	45.96	65.26	36.00	30.83	23.83	4.03
T_3: Biover@5kg enriched with FYM 5t/ha	46.50	66.33	37.33	32.00	25.26	4.66
T_4: Biomonas@5kg enriched with FYM 5t/ha	43.26	62.26	31.96	29.23	21.50	3.70
T_5: AAU-Bioguard @5kg enriched with FYM 5t/ha	41.80	61.00	30.03	29.03	20.16	3.36
T_6: Neem leaf powder @5g/plant	39.03	60.13	28.93	28.06	18.66	3.10
T_7: Control	35.46	53.43	22.46	26.56	17.20	2.76
S.E(d)	0.95	1.13	0.88	0.48	0.33	0.25
CD(P=0.05)	2.07	2.46	1.93	1.05	0.73	0.56

Table2. Effect of some bioformulations on multiplication of *Meloidogyne incognita*

Mean of 3 replications

Treatments	Number of	%	Number of	% decrease	Final	% decrease

	galls/plant	decrease over control	eggmasses /plant	over control	nematode population in soil (200cc)	over control
T_1: Neem cake @1t/ha	27.96	27.99	29.29	26.46	182.67	35.91
T_2: Biozium @5kg enriched with FYM 5t/ha	27.29	29.72	28.96	27.29	176.00	38.25
T_3: Biover@5kg enriched with FYM 5t/ha	25.17	35.18	27.17	31.79	172.00	39.65
T_4: Biomonas@5kg enriched with FYM 5t/ha	28.62	26.29	30.62	23.12	185.33	34.97
T_5: AAU-Bioguard @5kg enriched with FYM 5t/ha	30.19	22.25	32.19	19.18	195.00	31.58
T_6: Neem leaf powder @5g/plant	31.86	17.95	33.16	16.75	214.33	24.79
T_7: Control	38.83	-	39.83	-	285.00	-
S.E(d)	2.76		2.85		5.94	
CD(P=0.05)	6.09		6.28		13.08	

REFERENCES

1.Anonymous. Final estimates of 2020-21 Area and Production of Horticulture Crops. https://agricoop.nic.in/sites/default/files/202021%20 (Final) %20 Advance %20 Estimates% 202020-21 %20(1). 2021.

2.Khan MR, Pal AK. Plant parasitic nematodes associated with tuberose (Polianthes tuberosa L.) in West Bengal. Ann. Pl. Protec. Sci. 2001; 9: 357-359.

3.Singh AK. Flower crops cultivation and management. New India publishing agency, Pitam Pura, New Delhi-110 088, 2006; 658 p.

4.Sunderababu R, Vadivelu S. Pathogenicity of Meloidogyne species to tuberose (Polianthes tuberosa L.). Indian J. Nematol. 1988; 18: 146-148.

5.Khan RM, Reddy PP. Nematode problems of ornamental crops and their management. In: Nematode pests of crops (eds. D.S. Bhatti and R.K. Walia). DBS Publishers and Distributors, Delhi, India. 1992; pp. 250-257.

6. Rao MS, Reddy PP, Wallia RK. Biological contro1 of nematodes in horticultural crops. Nat. Nematol. Congr. - Centenary Celebration, December 2001, New Delhi, India.

7. Johnson AW. Pathogenicity of four root knot nematode species to Polianthes tuberosa. J. Nematol. 1970; 2:191-192.

8. Reddy PP. Bio-intensive nematode management in horticultural crops. Scientific Publishers, Jodhpur, India, 2012; p.300.

9. Rao MS, Shylaja M, Naik D. Management of nematode induced wilt disease complex in tuberose (Polianthes tuberose L.) cultivar prajwal using Pochonia chlamydosporia (Verticillium chlamydosporium) and Trichoderma harzianum. J. Ornam. Horticul. 2003; 6: 341-346.

10. Saha T, Khan MR. Evaluation of bioformulations for management of root knot nematode (Meloidogyne incognita) infecting tuberose. Pakistan J. Zool. 2016; 48(3): 651-656.

11.Shoresh M, Harman GE, Mastouri F. Induced systemic resistance and plant responses to fungal biocontrol agents. Annual Review of Phytopathology. 2010; 48: 21–43.

12. Hermosa R, Viterbo A, Chet I, Monte E. 2012. Plant-beneficial effects of Trichoderma and of its genes. Microbiology. 2012; 158: 17–25.

13. Naserinasab F, Sahebani N, Etebarian HR. Biological control of Meloidogyne javanica by Trichoderma harzianum BI and salicylic acid on Tomato. African Journal of Food Science and Technology. 2012; 5(3): 276 – 280.

14. Abhi R, Snehalatha P, Dash BK. Exploitation of bioagents for managing root-knot nematode, Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949 inciting black gram (Vigna mungo L.). Biological Forum – An International Journal.2022; 14(1): 848-856.

15. Verma M., Brar KS, Tyagi RD, Surampalli RY, Val Ero JR. Antagonistic fungi, Trichoderma spp.; Panoply of biological control. Biol. Engg. J. 2007; 37: 1-20.

16. Annapurna M., Bhagawati B, Kurulkar U. Biochemical mechanism of native fungal bioagents in the management of root-knot nematode Meloidogyne incognita on tomato. International Journal of Current Microbiology and Applied Science. 2018; 7(11): 380-395.