Journal of Entomology and Zoology Studies
Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(4): 646-648

Received: 21-05-2017
Accepted: 22-06-2017

Jothi G
Department of Plant Protection, ADAC&RI, Trichy, Tamil Nadu Agricultural University, Tamil Nadu, India

Poornima K
Department of Nematology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Correspondence
Poornima K
Department of Nematology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Potassium humate for the management of root knot nematode in tomato (*Lycopersicon esculentum*)

Jothi G and Poornima K

Abstract
Experiments were conducted under green house and field conditions to test the efficacy of potassium humate for the management of root knot nematodes in tomato at the department of Nematology, Tamil Nadu Agricultural University, Coimbatore during 2015. Humic acid products are powerful fungal stimulant and biological benefits in relation to nematode management. Two grams of potassium humate per kg soil was found to be effective in reducing the gall index and nematode population. The reduction in the reproduction factor (1.93) of the nematode may be responsible for the decrease in root knot indices. All the dosage of potassium humate had a significant effect in terms of nematode reduction and yield increase (57.3%) under field conditions. In addition, the change in physical as well as the tropic structure of soil which affects the nematode development and over all plant growth performance.

Keywords: Potassium humate, root knot nematode, *Lycopersicon esculentum*

1. Introduction

Plants grown in high organic matter often are damaged less by nematodes than are plants in soil of low organic matter content. Organic amendments both improve tolerance of plant host and apparently reduce nematode population [6]. Green manure, cow dung, poultry droppings dried crop residue [5, 7, 1] and industrial by products such as neem and castor oil cakes [6] have been successfully used. Reduction in nematode population was observed in both green house and field conditions with concomitant increase in growth and yield [2]. Amendments of soil with crop residues or other type of organic matter can suppress plant parasitic nematodes [14]. One proposed mode of action involves accumulation of low molecular weight organic acids. They are produced by fermentation of microorganisms and are readily oxidized to Co_2 and water by microorganisms under aerobic conditions. Organic acids are both phytotoxic and nematicidal [17]. They also alter the host parasite relationship there by minimize the nematode damage [3]

Tomato (*Lycopersicon esculentum*) is a major source of nutrients to man and income generating to its growers is exaggerated by infestation of nematodes. The yield reduction accounts to 28 to 68% [4].

Potassium humate, a coal derived products is known to exhibit properties of soil amelioration growth stimulation enhancement of crop yield and restoration of soil biodiversity and also resistant to nematode attack [9]. Many occurring compounds are known to possess nematicidal activity such as organic acids. Organic acids released during the decomposition of raw organic materials are one of many factors contributing to reduce nematodes population [13], but little is known about the direct effects of low-molecular-weight organic acids for nematode control [10]. Humic and Fulvic acids have been early recorded to have appositive effect against plant parasitic nematodes [11]. In many studies, humic and fulvic acids preparations were reported to increase the uptake of mineral elements [12]. Humate as an organic substances are available to achieve sustainability in agricultural production. They play a vital role because of their beneficial effects on physical, chemical and biological characteristics of soil [8]. The effectiveness of potassium humate in suppressing root knot nematodes affecting tomato was evaluated both under controlled laboratory conditions and field conditions. The aim of this investigation was to study the possibility of using Potassium humate to suppress root-knot nematode and their effect of growth and productivity of tomato.

2. Materials and Methods

2.1 Inplant experiment.

Seeds of tomato cv-Co.2 were sown and after four weeks, 2 seedlings were transplanted into each pot. Thereafter, one thousand second stage juveniles of *Meloidogyne incognita* were inoculated into each pot. The pots were filled with autoclaved soil and the potassium humate were given according to treatments one week before transplanting. The experiments were conducted in a screen house with the pot arranged in randomized block design. The plants were watered regularly. Six weeks after transplanting, the seedlings were uprooted and growth was observed in terms of plant height, plant weight and gall index. The nematode multiplication factor was also accessed.

2.2 Field experiment.

Field experiments were carried out in clay loam soil. Soil samples were taken before the treatments. The plot size of 1 m^2 was given the treatments of potassium humate with a untreated control.

2.3. Nematode assay.

The nematodes for this work were obtained from an infected tomato farm. The nematode population was extracted by using cobb's decantation and sieving techniques followed by modified Baermann's funnel method.

Root knot index was determined using [16] scale of 0 = No galling 1 = 1 – 10 galls, 2 = 11 – 20 galls, 3 = 21 – 30 galls, 4 = 31 – 100 galls and 5 = more than 100 galls.

2.4 Statistical analysis.

Three replicates were used for each experiment treatments. All data were subjected to a one way analysis of variance and means were compared with Newmwn Keuls multiple range test (P<0.05) using super ANOVA.

3. Results

From the results obtained (Table 1) it is evident that, all the treatments produced significantly (P=0.05) higher results than those of the inoculated untreated control. The results also showed significantly higher plant height, dry weight and lesser root knot indices. The nematode population was significantly reduced in 2 g HA / kg soil. The reduction in the reproduction factor (1.93) of the nematode may be responsible for the decrease in root knot indices.

In this field trial, the observation indicates that biometric observation was significantly higher compared to untreated control. The yield increased as the dosage of Potassium humate increased and highest was observed is 20 kg / ha by 57.3% with comparatively lesser nematode density.

Table 1: Optimization of humic acid against root knot nematodes in tomato

Treatments	shoot		root		Gall index	Soil population (200 cc soil)	Rf = pf/pi
	Height (cm)	weight (g)	Length (cm)	Weight (g)			
T1 - 1g	41.6	18.0	17.6	9.1	3.3	535	2.67
T2 - 2g	48.3	23.3	20.6	11.4	2.0	387	1.93
T3 - 3g	39.0	18.6	15.3	7.3	3.0	388	1.94
T4 - 4g	39.0	19.0	13.6	6.3	3.5	475	2.37
T5 - control	38.6	16.6	11.3	12.2	5.0	488	2.44
SED	2.1	2.3	1.2	0.5	0.4	60.1	-
CD (5%)	4.8	5.4	2.8	1.2	1.0	138.8	-

Table 2: Effect of potassium humate on growth and development of tomato infected by *Meloidogyne incognita* under field condition.

Treatments	Shoot		Root		Soil Population (200 cc)			RKI	Yield /plot	tonnes / ha	% increase in yield
	Height (cm)	Weight (g)	Length (cm)	Weight (g)	30 DAT	60 DAT	At harvest				
T1 - 5kg	81.48	88.0	22.14	22.42	395	462	372	3.8	15.4	38.7	14.4
T2 -10kg	94.2	93.68	22.4	21.6	389	412	262	4.2	17.0	42.5	25.7
T3 - 15kg	95.6	92.76	22.92	24.0	380	383	323	3.4	18.5	46.4	37.2
T4 -20kg	92.0	86.56	20.12	20.1	334	319	342	3.2	21.2	53.2	57.3
T5-control	88.4	83.60	19.08	18.94	535	534	539	5.0	13.5	33.8	--
CD @5%	1.5	1.01	0.32	0.61	20.1	19.2	18.7	0.03	0.8	--	

4. Discussion

The data show suppression of nematode affecting tomato by the natural product. The addition enhances the soil nutrients as a consequence, the nematode damage might have been markedly reduced [3]. The decrease in nematode may be the reason to increase the growth of seedlings. The reduction in reproduction factor of nematode may be responsible for the decrease in root knot indices. Oxihumates had a beneficial influence on the soil structure and biofauna. Water retention potential was 44% higher and renders the plant more resistant to nematode attack [9]. Nematode reduction was maximum in plants treated with mixture of urine and cowdung and nitrogen based amendments due to the presence of phenol, nematoxic chemicals [3]

Humic acid application consistently enhanced antioxidants such as á-tocopherol, â-carotene, superoxide dismutases, and ascorbic acid concentrations in plant [15] these antioxidants may play a role in the regulation of plant development, flowering and chilling of disease resistance [18].

5. Conclusion

In conclusion, Humic acid treatments improve the yield by increasing the contents of antioxidant compounds and the specific activities of antioxidant enzymes. plants grown in soils with high organic matter can both improve tolerance of the host plants and apparently reduce nematode population. They are better suited to keep nematode population relatively low than reducing high ones. There are several ways in which organic soil amendments help reduce nematode injury to plants.

The present results give an approach to control *M. incognita* in tomato plants using organic acids that are safer than nematicides can be used in place of carbofuran to manage *M. incognita* on tomato in view of its little cost, no known hazard to plant, man and environment.

6. Acknowledgement

The senior author is thankful to the Department of Science and Technology, GOI, New Delhi, for providing necessary facilities and financial assistance in the form of sanctioned project.

7. References

1. Abubakar U. Studies on the nematodes of cowpea *Vigna Unguiculata* of the Savanna regions of Northern Nigeria and Control of *Meloidogyne incognita* using selected plant extracts and animal manure. unpublished Ph.D. Thesis, Usmanu Danfodiyo University, Sokoto. 1999, 108.
2. Abubakar U, Majeed Q. Use of animal manure for the control of root-knot nematodes of Cowpea. Journal of Agriculture and Environment. 2000; 1(1):29-33.
3. Abubakar U, Adamu T, Manga SB. Control of *Meloidogyne incognita* (kofoid and white) chitwood (root-knot nematode) of *Lycopersicon esculentus* (tomato) using cowdung and urine. African Journal of Biotechnology. 2004; 3(8):379-381.
4. Adesiyan SO, Caveness FE, Adeniji MO, Fawole B. Nematode Pest of Tropical Crops. Heinemann Educational Books (Nig.) Pic, 1990.
5. Aktar M, Alam MM. Control of plant parasitic nematodes with agro-wastes soil amendment. Pakistan Journal of Nematology. 1990; 8:25-28.
6. Aktar M, Alam MM. Integrated control of plant parasitic nematodes on potato with organic amendment of plant parasitic nematodes. Nematicides and mixed cropping with mustard. Nematologica Mediterania. 1991; 19:169-171.
7. Aktar M, Alam MM. Effects of crop residue amendments to soil for the control ofplant parasitic nematodes. Bioresource Technology. 1992; 14:81-83.
8. Afifi MMI. Biochemical studies on humic substances extracted from organic fertilizers. Ph.D. Thesis, Dep. of Microbiology, Fac. Agric. Cairo University, 2010, 156.
9. Daneel MS, Jager K de, Dreyer S, Dekker J, Joubert JP. The influence of oxihumate on nematode control and on yield (*Musa* AAA,*Cavendish* Sub group). Proceedings of I International conference on banana and plantain for Africa. Acta horticulture. 2000; (540):441-452
10. El-Sherif AG, Gad SB, Khalil AM, Rabab HE, Mohamedy. Impact of four organic acids on *Meloidogyne incognita* infecting tomato plants under greenhouse conditions. Global Journal of Biology Agriculture and healthy sciences. 2015; 4(2):94-100.
11. El-Mougy, Nehal S, Abdel-Kader MM, Lashin SM. Vegetables Root Rot Disease Management by an Integrated Control Measures under Greenhouse and Plastic Houses Conditions in Egypt – A Review. International Journal of Engineering and Innovative Technology (IJEIT). 2013; 3(5):40-54.
12. Mackowiak CL, Grossl PR, Bugbee BG. Beneficial effects of humic acid on micronutrient availability to wheat. Soil Science Society of America Journal, 2001; 56:1744-1750.
13. McBride RG, Mikkelsen RL, Barker KR. The role of low molecular weight organic acids from decomposing rye in inhibiting root-knot nematode populations in soil. Applied Soil Ecology. 2000; 15:243-251.
14. McSorley R, Frederick JJ. Nematode population fluctuations during decomposition of specific organic amendments. Journal of Nematology. 1999; 31:37-44.
15. Sun Z, Xue S, Liang W, Liu Y. Effects of different application rates of humic acid compound fertilizer on pepper and its mechanism of anti-senility and incremental yield. Ying Yong Sheng Tai Xue Bao. 2004; 15:81-84.
16. Sasser JN, cater CC, Hartman KM. Standardization of host suitability studies and reporting of resistance to root knot nematode. Crop nematode Research and control project Raleigh, North Carolina, 1984, 7.
17. Takijima Y. Growth inhibiting action of organic acids and absorption and decomposition of them by soils. Soil Science Plant Nutrition. 1964; 12:435-442.
18. Ziadi S, Barbedette S, Godard JF, Monoti C, Corre LED, Silue D *et al*. Lecorre Production of pathogenesis related protein in the cauliflower (*Brassica oleacea* var. *botrytis*) downy mildew (*Peronospora parasitica*) pathosystem treated with acidbenzolar-5-methyl. Plant Pathology. 2001; 50(5):579-586.