



ISSN: 0974 - 0376

*The Ecoscan* : Special issue, Vol. VII: 305-309: 2015  
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES  
[www.theecoscan.in](http://www.theecoscan.in)

## MANAGEMENT OF MAIZE CYST NEMATODE, *HETERODERA ZEA* ON SWEET CORN (*ZEA MAYS* L. *SACCHARATA*) THROUGH SOIL AMENDMENT

B. L. Baheti *et al.*,

### KEYWORDS

Soil amendment  
Neem  
Karanj  
Lantana leaves  
*Heterodera zea*  
Sweet corn

Proceedings of National Conference on  
Harmony with Nature in Context of  
Bioresources and Environmental Health  
(HARMONY - 2015)  
November 23 - 25, 2015, Aurangabad,  
organized by  
Department of Zoology,  
Dr. Babasaheb Ambedkar Marathwada University  
Aurangabad (Maharashtra) 431 004  
in association with  
NATIONAL ENVIRONMENTALISTS ASSOCIATION, INDIA  
[www.neaindia.org](http://www.neaindia.org)



B. L. BAHETI, MUKESH DODWADIYA, B.S. RATHORE AND S.S. BHATI\*  
Department of Nematology, Rajasthan College of Agriculture,  
Maharana Pratap University of Agriculture and Technology, Udaipur -313 001, INDIA  
e-mail: shakti.singh3880@gmail.com

## ABSTRACT

The aim of this investigation was to study the effect of neem, karanj and lantana leaves powders as soil application at 1, 2 and 4 g/plant against maize cyst nematode, *H. zeae* on sweet corn (variety- Madhuri). A standard chemical (Phorate 10 G 2 kg a.i. / ha) and untreated check was also maintained for comparison. Observations on shoot weight (g), root weight (g), cyst per 100 cc soil, cyst per plant and final larvae population per 100 cc soil were recorded to interpretate the experimental findings. Results revealed that plant products enhanced growth of sweet corn and reduced nematode infection over untreated check. The results obtained in present investigation showed that maximum (40.48 %) increase in shoot weight and maximum (49.41 %) per cent reduction in cyst per 100 cc soil was observed with the application of neem leaves powder at 4 g/plant. On the whole, among different plant leaves powder, neem leaves at 4 g/plant was found most effective in improving plant growth of sweet corn and to reduced the infection of maize cyst nematode, *Heterodera zeae*.

## INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops of the world, ranking third after rice and wheat in terms of area as well as production. Maize also ranks third in importance among India's cereal crops covering nearly about 9.43 million hectares of area with production and productivity of 24.35 million tonnes and 2583 kg/ha, respectively during 2014-15 (Anon, 2015). It is extensively grown in Rajasthan, Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab and Uttar Pradesh in India. In Rajasthan, it occupies 9.16 lakh hectare of area having a production of 14.63 lakh tonnes resulting productivity of 1597 kg/ha during 2014-15 (Anon, 2015). For diversification and value addition of maize as well as growth of food industry recently especiality corns viz. sweet corn, pop corn, baby corn, quality protein maize, high oil corn etc. is becoming popular not only in India but in the international market as well. They give higher returns to the growers as compared to general maize. Out of the various especiality corns, sweet corn has tremendous market potential because it contains higher sugar and used in variety of delicious food products.

Maize production is greatly affected by several biotic factors i.e. fungi, bacteria, insect pests and nematodes. Among them, plant parasitic nematodes are responsible to cause 10.2% losses on maize (Sasser and Freckman, 1987). Plant parasitic nematodes viz., cyst nematodes (*Heterodera* spp.), lesion nematodes (*Pratylenchus* spp.), root knot nematodes (*Meloidogyne* spp.), stunt nematode (*Tylenchor hynchus* spp.) and spiral nematode (*Helicotylenchus* spp.) have been found to be associated with maize (Patel *et al.*, 2000). These nematodes apart from causing losses by themselves interact with other disease causing agents and adversely affect the quality and quantity of maize production. Among nematodes, maize cyst nematode, *Heterodera zeae* (Koshy *et al.*, 1970) has been recognized as key nematode pest of maize including especiality maize in India and reported to causes significant yield losses (Singh and Rathore, 2001; Srivastava and Chawla, 2005). It is widely distributed in maize growing states of the country (Kaushal *et al.*, 2007). The losses are comparatively higher in Rajasthan due to mono-cropping, favourable soil and environmental conditions etc. Keeping this in view, present investigation was carried out to find out eco-friendly management option of maize cyst nematode on sweet corn.

## MATERIALS AND METHODS

An experiment was carried out to test the efficacy of Neem, Lantana and Karanj leaves powder for the management of maize cyst nematode, *H. zeae* on sweet corn (Variety-Madhuri) as soil application. These plant products were applied @ 1, 2, 4 g/plant as soil application. A standard chemical check (Phorate @ 2 kg a.i./ha) and untreated check was also maintained for comparison. The required quantity of plant products and chemicals were calculated and weighed separately for each pot and mixed well in soil. Soil samples were processed to estimate the initial nematode population before sowing. The experiment was laid out in completely randomized design with four replications. All practices were adopted throughout the experimental

\*Corresponding author

period for proper growth of plants. Observation on shoot weight (g), root weight (g), number of cyst per 100cc soil, cyst per plant and final larvae population per 100cc soil were recorded for comparison of various treatments. Results were statistically analysed to interpretate the experimental findings. The results have been presented in Table 1 and illustrated through Fig.1 and 2.

## RESULTS AND DISCUSSION

The activity of plant parasitic nematodes is governed by host plant, climate and soil environment. Changes in any of these factors influence the nematode activity directly as well as indirectly. Amendment of soil with plant products is recognized as efficient method for changing the soil environment and it adversely affect the life cycle of nematodes and enable the plant to resist the attack of nematodes. It appears to be a good tool for reducing nematode density, infectivity and host proneness. In comparison to chemicals, some of the merits of organic amendment are building up of soil fertility, comparatively economical, having beneficial effect on succeeding crop, harmless to beneficial soil microbes, easy in application, non-pollutant, no extra care and precautions involved. Therefore, in present investigation neem, karanj and lantana leaves powder were used at 1, 2 and 4 g/plant as soil application for the management of maize cyst nematode, *H. zea* on sweet corn.

Results exhibited that shoot weight of sweet corn enhanced with the application of organic amendment over untreated control. Among various treatments, maximum shoot weight (29.50 g) was obtained with neem leaves powder at 4 g/plant followed by karanj leaves powder at 4 g/plant and neem leaves powder at 2 g/plant (27.25 g). Minimum shoot weight (21.00 g) was observed in untreated control and was found at par with lantana leaves powder when applied at 1 g/plant (22.50 g). Shoot weight was found significantly better with neem leaves powder at 4 g/plant. Highest shoot weight (31.25 g) was obtained with the application of phorate at 2 kg a.i./ha. Results revealed maximum increase in shoot weight (40.48 %) with neem leaves powder at 4 g/plant followed by karanj leaves powder at 4 g/plant and neem leaves powder at 2 g/

plant (29.76 %). Minimum increase in shoot weight was obtained in lantana leaves powder (7.14 %) when applied at 1 g/plant over untreated control. However, highest increase in shoot weight (48.81 %) was recorded with phorate at 2 kg a.i./ha. Similar results were also obtained with respect to root weight.

The results obtained in present investigation are also in accordance with the findings of Parvatha Reddy *et al.* (1993), Nanjegowda *et al.* (1998), Ravindra *et al.* (2003) and Verma and Khan (2004). Parvatha Reddy *et al.* (1993) applied chopped leaves of neem, lantana, *Calotropis*, castor, marigold, mustard, *Parthenium*, sesame and periwinkle each at 100 g / 2 kg *Meloidogyne incognita* infested soil on papaya and observed that castor and neem leaves gave maximum shoot length and weight Similarly, Nanjegowda *et al.* (1998) tested the efficacy of various neem products (neem seed kernel, neem leaf, neem cake, nimbidine) and a nematicide (carbofuran) against *M. incognita* in tomato nursery. They reported that all the neem products including neem leaves increased the plant growth of tomato in nursery. Ravindra *et al.* (2003) evaluated the efficacy of neem and pongamia cake at 10, 20 and 30 g/ plant, applied directly to the base. Pongamia cake at 30 g/ plant recorded maximum green and cured leaf yield of tobacco. Verma and Khan (2004) tested the efficacy of green chopped leaves of neem, datura, eucalypts, tulsi, *Parthenium*, madar, sadabahar, subabool, mint and *Clerodendrum* against *Meloidogyne incognita* on Tulsi (*Ocimum canum*). They observed that all the treatments improved plant growth at varying levels. Length of roots and shoot were highest with the application of neem leaves. The highest increase in weight was exhibited by neem treatment.

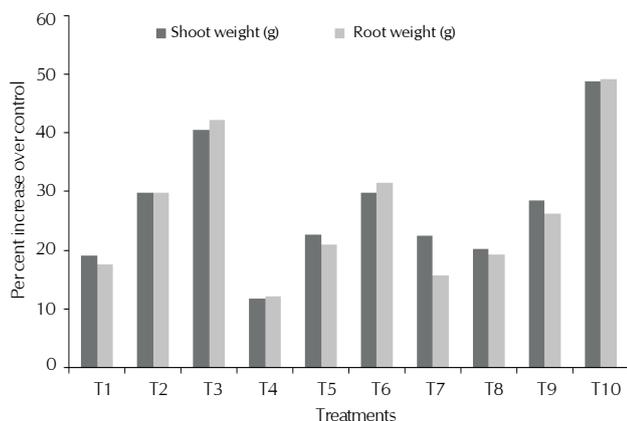
These findings supports, that application of plant products as soil application enhanced plant growth in nematode prone areas. This might be due to the fact that soil application with plant products improved physical condition of soil, reduce population of plant parasitic nematodes and enhances the activity of beneficial soil microbes.

With respect to nematode parameters, minimum cyst per 100 cc soil (10.75) was recorded with the application of neem leaves powder at 4 g/plant followed by karanj leaves powder

**Table 1: Effect of neem, karanj and lantana leaves as soil amendment against *Heterodera zea* on sweet corn (*Zea mays* L. *saccharata*)**

Treatments		Plant Growth Characters(P.G.C.)		Nematode Parameters(N.P.)		Final larvae population / 100 cc soil
		Shoot weight (g)	Root weight(g)	Cyst /100 cc soil	Cyst/ plant	
Neem leaves powder 1 g/plant	(T <sub>1</sub> )	25.00(19.05)	16.75(17.54)	15.75(25.88)	16.25(26.14)	450.00(26.23)
Neem leaves powder 2 g/plant	(T <sub>2</sub> )	27.25(29.76)	18.50(29.82)	13.00(38.82)	14.75(32.95)	350.00(42.62)
Neem leaves powder 4 g/plant	(T <sub>3</sub> )	29.50(40.48)	20.25(42.11)	10.75(49.41)	11.00(50.00)	290.00(52.46)
Karanj leaves powder 1 g/plant	(T <sub>4</sub> )	23.50(11.90)	16.00(12.28)	17.00(20.00)	17.75(19.32)	490.00(19.67)
Karanj leaves powder 2 g/plant	(T <sub>5</sub> )	25.75(22.62)	17.25(21.05)	14.50(31.76)	15.00(31.82)	400.00(34.43)
Karanj leaves powder 4 g/plant	(T <sub>6</sub> )	27.25(29.76)	18.75(31.58)	12.75(40.00)	13.50(38.64)	340.00(44.26)
Lantana leaves powder 1 g/plant	(T <sub>7</sub> )	22.50(7.14)	15.75(10.53)	17.25(18.82)	18.00(18.18)	510.00(16.39)
Lantana leaves powder 2 g/plant	(T <sub>8</sub> )	25.25(20.24)	17.00(19.30)	15.00(29.41)	15.75(28.41)	430.00(29.51)
Lantana leaves powder 4 g/plant	(T <sub>9</sub> )	27.00(28.57)	18.00(26.32)	13.25(37.65)	14.00(36.36)	360.00(40.98)
Phorate 10 G 2 kg a.i./ha	(T <sub>10</sub> )	31.25(48.81)	21.25(49.12)	7.25(65.88)	7.50(65.91)	220.00(63.93)
Untreated check	(T <sub>11</sub> )	21.00	14.25	21.25	22.00	610.00
SEm ±		0.667	0.492	0.749	0.731	11.128
CD at 5 %		1.920	1.416	2.154	2.103	32.018

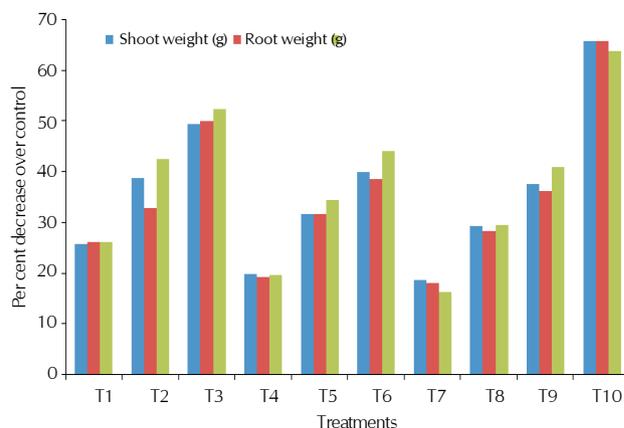
Initial nematode population: 600 larvae/100 cc soil; Figures in parentheses are per cent increase (P.G.C.) or decrease (N.P.) over control; Data are the average of four replications



**Figure 1: Effect of plant products as soil application on plant growth of sweet corn infested with *Heterodera zae***

at 4 g/plant (12.75) and neem leaves powder at 2 g/plant (13.00) whereas maximum cyst population (17.25) was observed in lantana leaves powder when applied at 1 g/plant. Neem leaves powder at 4 g/plant was found significantly better with respect to reducing cyst per 100 cc soil over rest of the botanicals. However, phorate at 2 kg a.i./ha (7.25 cyst per 100 cc soil) was found significantly better over plant products. Maximum number of cyst per 100 cc soil (21.25) was recorded in untreated control. Per cent reduction in cyst per 100 cc soil was calculated with different treatments over untreated control. It was observed maximum with the application of neem leaves powder (49.41 %) followed by karanj leaves powder at 4 g/plant (40.00%) and neem leaves powder at 2 g/plant (38.82 %). Organic amendment with leaves powders i.e. lantana and karanj at 1 g/plant reduced cyst population in soil to the tune of 18.82 per cent and 20.00 per cent, respectively. Among all the treatments, highest reduction (65.88 %) was obtained with phorate at 2 kg a.i./ha over untreated control. Almost similar trend was obtained with regard to cyst/plant and final larvae population/100 cc soil.

The results obtained in present investigation are also in accordance with the findings of Singh (1991) who applied chopped leaves of karanj to soil infested with *Meloidogyne javanica* and obtained 50% reduction in root knot infestation on tomato. Bhatti (1988) tested chopped leaves of eight plant species against *H. cajani* and seven plants against *H. avenae*. They observed that dose of 40 and 80 g/kg soil was highly superior. *Azadirachta indica*, *Datura stramonium*, *Leucaena leucocephala* and *Ricinus communis* were most effective against *H. cajani* and *Bogainvillea spectabilis* against *H. avenae*. Akhtar and Alam (1989) reported that the incorporation of chopped leaves of *Azadirachta indica* (Neem), *Lantana camara*, *Calotropis procera*, *Eucalypts citriodera* at 50 or 100 g/pot significantly suppressed build up of *Hoplolaimus indicus*, *Helicotylenchus indicus*, *Tylenchor Hynchus brassicae*, *Rotylenchulus reniformis* and *Tylenchus filiformis* on *Capsicum annum* cv. NP-46A. They also observed that higher doses gave better results and the greatest reduction in nematode population. Ajith and Sheela (1996) reported that application of chopped green leaves of neem effectively reduced plant parasitic nematodes on okra and cowpea and



**Figure 2: Effect of plant products as soil application against maize cyst nematode, *Heterodera zae* on sweet corn**

subsequently increased crop yield. Bhardwaj and Trivedi (1999) tested leaf powder of five locally available plants viz., *Azadirachta indica*, *Calotropis procera*, *Nerium indicum*, *Lantana camara* and *Lowsonia intermis* against *Heterodera cajani* on cowpea and observed that all the leaf powder significantly controlled the population of *Heterodera cajani* to varying degree. However, *Azadirachta indica* leaves showed best results. Javed *et al.* (2005) also tested the efficacy of neem products (leaves, cake and seeds) at 25, 50, 100 and 500 g of soil against root-knot nematode. They found that the neem products significantly reduce the vigour and mobility of root-knot juveniles in the treated soil as compared to untreated soil. Neem leaves were more toxic to juveniles over neem cake and seed.

The suppression of nematodes in amended soil may be because of the effect of several combined factors. Production of volatile fatty acids, phenols, ammonia, amino acids, HCN etc. during decomposition of plant products which may cause inhibitory effect to the nematodes. The decomposed products may be directly toxic to nematodes or the microbial metabolites produced during decomposition may be toxic to nematodes or enhance activity of predators and parasites which may feed on the nematodes.

## ACKNOWLEDGEMENT

The authors are highly grateful to the Head, Department of Nematology, Rajasthan College of Agriculture, MPUAT, Udaipur (Raj) for providing necessary facilities and critically reviewed the article.

## REFERENCES

- Ajith, K. and Sheela, M. S. 1996. Utilization of green leaves of neem and evaporium for management of soil organisms in bhindi and cowpea. *Indian J. Nematology*. **26**: 139-43.
- Akhtar, M. and Alam, M. M. 1989. Evaluation of nematicidal potential in some nematocidal plants. *International Nematology Network Newsletter*. **6**: 8-10.
- Bhardwaj, P. and Trivedi, P. C. 1999. Biopesticides in the management of *Heterodera cajani* on cowpea. *Proceeding of the National Academy of Sciences India Section-B. Biological Sciences*. **69**: 343-45.

- Bhatti, D. S. 1988.** Utilization of toxic plants for the control of nematode pests of economic crops. *Final Technical Report, Haryana Agricultural University, Hisar, India.* p. 231.
- Anonymous 2015.** Department of Agriculture and Cooperation, New Delhi.
- Javed, N., Inam-ul-Haq, M. and Khan, S. A. 2005.** Mobility of juveniles of root-knot nematode (*Meloidogyne javanica*) through soil amendment with neem (*Azadirachta indica*, A. Juss) products. *Pakistan J. Agricultural Sciences.* **42:** 58-60.
- Kaushal, K. K., Shrivastava, A. N., Pankaj, Chawla, G. and Singh, K. 2007.** Cyst forming nematodes in India- A review. *Indian J. Nematology.* **37:** 1-7.
- Koshy, P. K., Swarup, G. and Sethi, C. L. 1970.** *Heterodera zea* sp. (Nematoda: Heteroderidae). A cyst forming nematode on *Zea mays*. *Nematologica.* **16:** 511-16.
- Nanjegowda, M., Reddy, P. P. and Nagesh, M. 1998.** tested the efficacy of various neem products against *M. incognita* in tomato nursery. *Indian J. Nematology.* **13:** 8-14.
- Parvatha Reddy, P., Khan, R. M. and Rao, M. S. 1993.** Management of root-knot nematode infesting papaya by incorporating some plant leaves. *Botanical pesticides in integrated pest management: Proceedings of National Symposium held at Central Tobacco Research Institute, Rajamundry, 533-105, India* pp. 421-23.
- Patel, N. B., Patel, R. G., Patel, A. D., Patel, H. V., Patel, B. A. and Patel, D. J. 2000.** Occurrence and distribution of *Tylenchorhynchus vulgaris* and *Pratylenchus zea* in maize growing areas of Panchmahal district of Gujrat. *Indian J. Nematology.* **30:** 95-96.
- Ravindra, H., Onkarappa, T., Vasuki, N., Krishnappa, K., Narayanaswamy, H. and Basavaraja, M. K. 2003.** Effect of oil cakes on management of root-knot nematode, yield and quality of FCV tobacco. *Indian J. Nematology.* **33:** 56-59.
- Sasser, J. N. and Freckman, D. W. 1987.** World Perspective on Nematology: the role of the Society. In *Vistas on Nematology: a Commemorations of the Twenty fifth Anniversary of the Society of Nematologists.* J.A. Veech and D.W. Dickson, eds. Society of Nematologists, Inc. *Hyattsville, M.D.* pp. 7-14.
- Singh, H. and Rathore, B. S. 2001.** Estimation of yield losses in maize due to maize cyst nematode, *Heterodera zea*. In: National Congress on Centenary of Nematology in India - Appraisal and Future Plans held at IARI, New Delhi from 5-7 Dec. 2001 p. 157.
- Singh, C. 1991.** *Modern Techniques of Raising Field Crops*, Oxford and IBH Publications, New Delhi, pp. 74-94.
- Srivastava, A. N. and Chawla, G. 2005.** Maize cyst nematode, *Heterodera zea* a key nematode pest of maize and its management. *IARI, New Delhi*-18 pp.
- Verma, A. C. and Khan, M. N. 2004.** Potentiality of botanicals for managing *Meloidogyne incognita* in *Ocimum canum*. *Annals of Plant Protection Sciences.* **12:** 464-65.

