Organic amendment—An important tool for the management of maize cyst nematode, *Heterodera zeae* on maize (*Zea mays* L.)

K.K. Meena, B.L. Baheti, B.S. Rathore and B.S. Chandrawat

Received January 15, 2015 and Accepted May 27, 2015

ABSTRACT : Plant products plays an important role in management of plant parasitic nematodes as soil amendment. Therefore, in present investigation neem (*Azadirachta indica*), jatropha (*Jatropha curcas*) and lantana (*Lantana camara*) leaves powder were used at 1, 2 and 4 q/ha as organic amendment for the management of maize cyst nematode, *Heterodera zeae* on maize. Results revealed that plant products significantly enhanced growth of maize and reduced nematode infection over check. However, neem leaves powders at 4 q/ha was found to be the most effective in improving growth of maize and reducing infection of *Heterodera zeae*.

Key Words: Management, plant products, soil application Heterodera zeae, maize.

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 botanicals 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, jatropha and lantana leaves powder were used @ 1, 2 and 4 g/ha as organic amendment for the management of maize cyst nematode, H. zeae on maize.

Materials and Methods

Organic amendment plays an important role in management of plant parasitic nematodes. With this view, trial was planned and conducted to test the efficacy of neem, jatropha and lantana leaves powder for the management of maize cyst nematode, H. zeae on maize. These plant products were applied @ 1, 2 and 4 q/ha as soil amendment. A standard chemical check (phorate @ 2 kg a.i. /ha) and untreated check was also maintained. The required quantity of leaves and chemicals were calculated and weighed separately for each pot and mixed well in soil. Soil samples were collected to estimate the initial nematode population. The experiment was laid out in completely randomized design with five replications. Maize variety Pratap Maize-3 was sown and all practices were adopted throughout the experiment period. Observations viz., shoot weight (g), root weight (g), number of cyst per

plant, number of cyst per 100 cc soil and final larvae population / 100 cc soil were recorded for comparison of treatments. Data were compiled and analyzed for interpretation of findings.

Results and Discussion

Results revealed that shoot weight of maize significantly enhanced with the application of organic amendment over untreated control. Among organic amendments, maximum shoot weight (29.18 g) was obtained with neem leaves powder @ 4 q/ha followed by jatropha leaves powder @ 4 q/ha (26.60 g) and neem leaves powder @ 2 q/ha (26.54 g). Minimum shoot weight (22.74 g) was observed with lantana leaves powder when applied @ 1 q/ha and was differed significantly from untreated control. Shoot weight increased significantly with neem leaves powder @ 4 q/ha over rest of the treatments. Significantly higher shoot weight (30.70 g) was obtained with the application of phorate @ 1 kg a.i./ha over all the organic amendments.

Results exhibited that maximum increase in shoot weight (42.90%) was recorded with neem leaves powder @ 4 q/ha followed by jatropha leaves powder @ 2 q/ha (30.26 %) and neem leaves powder @ 2 q/ha (29.97 %). Minimum increase in shoot weight was obtained in lantana leaf powder (11.36 %) when applied @ 1 q/ha over untreated control. However, highest increase in shoot weight (50.34 %) was recorded with phorate @ 1 kg a.i./ha. Similar trend was also observed with respect to root weight of maize.

Several workers also reported the efficacy of different botanicals in nematode prone areas. Singh *et al.* (1980) observed that soil amendment with oil cakes of castor, mustard, neem @ 20 g/kg soil and mahua @ 33.3 g/kg soil significantly increased the growth of tomato var. Marglobe. Bhatti (1988) tested eight plant species against *H. cajani* and seven plants against *H. avenae*. Chopped leaves mixed in potted soil @ 10,

ſreatments		Plant growth	characters	I	Nematode populatio	uc
		Shoot	Root	Cyst	Cyst	Final larvae
		weight	weight	/100 cc	/plant	population
		(g)	(g)	soil		/100 cc soil
Veem leaves powder 1q /ha	(T ₁)	24.22	17.04	16.40	16.80	463.60
		(18.61)	(17.03)	(24.77)	(25.66)	(29.93)
Veem leaves powder 2q /ha	(T_2)	26.54	18.76	13.60	14.40	365.20
	1	(29.97)	(28.85)	(37.61)	(36.28)	(44.80)
Jeem leaves powder 4q /ha	(T ₃)	29.18	20.48	11.40	11.60	275.00
	c.	(42.90)	(40.66)	(47.71)	(48.67)	(58.43)
atropha leaves powder 1q/ha	(T ₄)	22.92	16.32	17.60	18.40	507.60
		(12.24)	(12.09)	(19.27)	(18.58)	(23.28)
atropha leaves powder 2q/ha	(T ₅)	25.08	17.56	15.20	16.20	418.40
	,	(22.82)	(20.60)	(30.28)	(28.32)	(36.76)
atropha leaves powder 4q/ha	(T ₆)	26.60	18.86	13.40	14.20	358.00
		(30.26)	(29.53)	(38.53)	(37.17)	(45.89)
antana leaves powder 1 q/ha	(T_{γ})	22.74	16.18	17.80	18.60	520.00
		(11.36)	(11.13)	(18.35)	(17.70)	(21.40)
antana leaves powder 2 q /ha	(T ₈)	24.76	17.26	15.60	16.40	442.00
	I	(21.25)	(18.54)	(28.44)	(27.43)	(33.19)
antana leaves powder 4 q/ha	(T ₉)	26.16	18.64	13.80	14.60	370.40
	L.	(28.11)	(28.02)	(36.70)	(35.40)	(44.01)
horate 10 G @ 1 kg a.i./ha	(T_{10})	30.70	21.60	8.80	9.00	141.00
		(50.34)	(48.35)	(59.63)	(60.18)	(78.69)
Intreated check	(T ₁₁)	20.42	14.56	21.80	22.60	661.80
SEm ±		0.461	0.538	0.473	0.508	32.846
CD at 5 %		1.315	1.534	1.348	1.448	93.616

Table-1: Effect of botanicals as soil amendment for the management of *Heterodera zeae* on maize

K.K. MEENA et al.

25

20, 40 and 80 g/kg resulted in better plant growth parameters and reduced population of nematodes. **Parvatha Reddy** *et al.* (1993) applied chopped leaves of neem, lantana, *Calotropis*, castor, marigold, mustard, *Parthenium*, sesamum and periwinckle each at 100 g/2 kg *Meloidogyne incognita* infested soil on papaya cv. Coorg Honey Dew under glass house conditions 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, nimbicidine) and a nematicide (carbofuran) against *M. incognita* in tomato nursery. All the neem products and carbofuran significantly reduced the nematode population and increased the plant growth. However, carbofuran was found to be most effective followed by neem seed kernel and cake. 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.

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

Amongst organic amendments, minimum cyst per 100 cc soil (11.40) was recorded with the application of neem leaves powder @ 4 q/ha followed by jatropha leaves powder @ 4 q/ha (13.40) and neem leaves powder @ 2 q/ha (13.60), whereas maximum cyst population (17.80) was observed in lantana leaves powder when applied @ 1 q/ha. Neem leaves powder @ 4 q/ha was found significantly better with respect to reducing cyst per 100 cc soil over rest of the plant products. However, phorate @ 1 kg a.i./ha was found significantly better over others and produced 8.80 cyst per 100 cc soil. Maximum cyst per 100 cc soil (21.80) was recorded in untreated control. Analysis of data showed that cyst per 100 cc soil reduced significantly with the application of treatments over untreated control.

Per cent reduction in cyst per 100 cc soil was calculated with different treatments over untreated control. It was observed maximum (47.71%) with the application of neem leaves powder followed by jatropha leaves powder @ 4 q/ha (38.53%) and neem leaves powder @ 2 q/ha (37.61%). Organic amendment with leaves powders i.e. lantana and jatropha @ 1 q/ha reduced cyst population in soil to the tune of 18.35 per cent and 19.27 per cent, respectively. Among all the treatments, highest reduction (59.63%) was obtained with phorate @ 1 kg a.i./ha over untreated control. Similar trend was noticed with regards to cyst per plant and final larvae population per 100 cc soil.

The results obtained in present investigation are also in accordance with the findings of Akhtar and Alam (1989) who 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, Tylenchorhynchus brassicae, Rotylenchulus reniformis and Tylenchus filiformis on Capsicum annum cv. NP-46A. Higher doses gave better results and chopped leaves of Calotropis procera produced 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 subsequently increased crop yield. Ahmad and Alam (1996) tested the efficacy of organic amendments against Rotylenchulus reniformis on blackgram. Oil seed cake and chopped leaves of neem, castor and rice were found effective in improving plant growth of

blackgram. Neem cake was the most effective (41.9%) followed by castor cake (39.0%), rice polish (34.8%), neem leaf (30.3 %) and castor leaf (23.9%).

Bhardwaj and Trivedi (1999) tested leaf powder of five locally available plants viz., Azadirachta indica, Calotropis procera, Nerium indicum, Lantana camara and Lowsonia intermis agaisnt Heterodera cajani on cowpea and observed that all the leaf powders 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 reduced the vigour and mobility of root-knot juveniles in the treated soil as compared to untreated soil. Neem leaves were more toxic to juveniles compared with 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 feed on the nematodes.

Acknowledgment

The authors are highly grateful to the Head, Department of Nematology for providing necessary facilities and critically review the article.

References

- Ahmad, A. and Alam, M.M., 1996. Efficacy of some organic amendments against reniform nematode, *Rotylenchulus reniformis* on blackgram. *Annals of Plant Protection Sciences*, 4: 122-25.
- Ajith, K. and Sheela, M.S., 1996. Utilization of green leaves of neem and evapotorium for management of soil organisms in bhindi and cowpea. *Indian Journal* of 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* : 231.
- 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 Journal of Agricultural Sciences*, 42 : 58-60.
- Nanjegowda, D.; Naik, B.G.; Ravi, K.; Reddy, P.P.; Kumar, N.K.K. and Verghese, A., 1998. Efficacy of neem products and a nematicide for the management of