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

B. L. Baheti *et al*.

**KEYWORDS**

- Soil amendment
- Neem
- Karanj
- Lantana leaves
- *Heterodera zeae*
- Sweet corn


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
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 hectares 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 speciality 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 speciality 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 speciality maize in India and reported to causes significant yield losses (Singh and Rathore, 2001; Srivastavaand 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.

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
period for proper growth of plants. Observation on shoot weight (g), root weight (g), number of cyst per 100 cc soil, cyst per plant and final larvae population per 100 cc soil were recorded for comparison of various treatments. Results were statistically analysed to interpret 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 crops, 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. zeae* 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*, sesamum and permwinkle 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, nimbicidine) 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 zeae* on sweet corn (*Zea mays* L. *saccharata*)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant Growth Characters (P.G.C.)</th>
<th>Nematode Parameters (N.P.)</th>
<th>Final larvae population / 100 cc soil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shoot weight (g)</td>
<td>Root weight (g)</td>
<td>Cyst /100 cc soil</td>
</tr>
<tr>
<td>Neem leaves powder 1 g/plant</td>
<td>(T1)</td>
<td>25.00 (19.05)</td>
<td>16.75 (17.54)</td>
</tr>
<tr>
<td>Neem leaves powder 2 g/plant</td>
<td>(T2)</td>
<td>27.25 (19.76)</td>
<td>18.50 (29.82)</td>
</tr>
<tr>
<td>Neem leaves powder 4 g/plant</td>
<td>(T3)</td>
<td>29.50 (40.48)</td>
<td>20.25 (42.11)</td>
</tr>
<tr>
<td>Karanj leaves powder 1 g/plant</td>
<td>(T4)</td>
<td>23.50 (19.90)</td>
<td>16.00 (12.28)</td>
</tr>
<tr>
<td>Karanj leaves powder 2 g/plant</td>
<td>(T5)</td>
<td>25.75 (22.62)</td>
<td>17.25 (21.05)</td>
</tr>
<tr>
<td>Karanj leaves powder 4 g/plant</td>
<td>(T6)</td>
<td>27.25 (29.76)</td>
<td>18.75 (31.58)</td>
</tr>
<tr>
<td>Lantana leaves powder 1 g/plant</td>
<td>(T7)</td>
<td>22.50 (7.14)</td>
<td>15.75 (10.53)</td>
</tr>
<tr>
<td>Lantana leaves powder 2 g/plant</td>
<td>(T8)</td>
<td>25.25 (20.24)</td>
<td>17.00 (19.30)</td>
</tr>
<tr>
<td>Lantana leaves powder 4 g/plant</td>
<td>(T9)</td>
<td>27.00 (28.57)</td>
<td>18.00 (26.32)</td>
</tr>
<tr>
<td>Phorate 10 G 2 kg a.i./ha</td>
<td>(T10)</td>
<td>31.25 (48.81)</td>
<td>21.25 (49.12)</td>
</tr>
<tr>
<td>Untreated check</td>
<td>(T11)</td>
<td>21.00</td>
<td>14.25</td>
</tr>
<tr>
<td>SEM ±</td>
<td>0.667</td>
<td>0.492</td>
<td>0.749</td>
</tr>
<tr>
<td>CD at 5 %</td>
<td>1.920</td>
<td>1.416</td>
<td>2.154</td>
</tr>
</tbody>
</table>

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.
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. Bhati (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 Bogainvillia spectabilis against H. avenae. Akhtar and Alam (1989) reported that the incorporation of chopped leaves of Azadirachta indica (Neem), Lantana camara, Calotropis procera, Eucalyptus citriodora at 50 or 100 g/pot significantly suppressed build up of Hoplolaimus indicus, Helicotylenchus indicus, Tylenchor Hynchus brassicaceae, 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 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 internis 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


