Assessment of losses due to root-knot nematode, Meloidogyne incognita on cluster bean (Cyamopsis tetragonoloba L.)

CP Nama and BL Baheti

Abstract

Legume crop production is highly affected by plant parasitic nematodes. In order to work out the loss estimates in cluster bean (Cyamopsis tetragonoloba L.) attacked by root-knot nematode, Meloidogyne incognita. An investigation on estimation of avoidable losses on cluster bean was carried out during Kharif 2015 and 2016 with the application of phorate 10 G at 2 kg per ha in soil which is naturally infested with root-knot nematode, Meloidogyne incognita. Results showed that application of phorate 10 G significantly reduced nematode population and the avoidable losses estimated 42.88 per cent.

Keywords: avoidable losses, Meloidogyne incognita, cluster bean and assessment

Introduction

Root-knot nematode (Meloidogyne incognita) is considered as most important pest of agronomical and horticultural crops including cluster bean (Seshadri, 1970; Sassier, 1980 and Singh and Kumar, 2015) [20, 16, 21] and farmers experience chronic losses because of the high frequency of this nematode (Bhatti and Jain, 1977; Parvatha Reddy, 1986) [1, 15]. Root-knot nematode received greater attention in India and abroad due to its polyphagous nature, cosmopolitan distribution and adaptability to adverse conditions. Several plant parasitic nematodes viz., Meloidogyne incognita, M. javanica, Rotylenchulus reniformis, Helicotylenchus incises, Pratylenchus delattrei, Tylencythrhynchus capitatus, Xiphinema sp., Tylenchus sp., Criconema sp. and Apheleunchus sp. have been found associated with cluster bean in India and abroad (Bishnoi and Yadav, 1989; Rao et al., 2007; Shaukat et al., 2010) [19]. Datta et al. (1987) [4] reported that Meloidogyne incognita, M. javanica, Rotylenchulus reniformis, Heteroderca cafrican and Tylenchorynchus phaseli were the most widespread and dominant nematodes on cluster bean.

Sasser and Freckman (1987) [17] estimated overall 12.3 per cent annual yield loss of world’s major crops due to damage by phytoparasitic nematodes. Estimated annual yield losses were recorded in okra (20.2-90.9%), brinjal (33.68-43.0%), tomato (27.21-47.8%), cowpea (28.6%), chilli (12.05%), pea (20.0-46.0%), bottle gourd (35-55.4%) and cucurbits (18.2%) due to root-knot nematode, Meloidogyne incognita in different agro-ecological conditions of India (Bhatti and Jain; 1977; Parvatha Reddy and Singh; 1981, Parvatha Reddy; 1985, Jain et al.; 1986, Parvatha Reddy; 1986, Sharma and Baheti; 1992, Jain et al.; 1994, Jain et al.; 2007 and Singh and Kumar; 2015) [1, 14, 13, 9, 15, 18, 8, 7, 21].

In view of this, the present investigations were carried out at farmer’s field to study the avoidable losses in cluster bean due to root-knot nematode, Meloidogyne incognita.

Material and Methods

The experiment was carried out in two conjugative Kharif seasons on farmer’s field naturally infested with root-knot nematode, Meloidogyne incognita at Behuti near Udaipur having light textured soil. Analysis of soil was done with the help of International Pipette Method (Wright, 1939) [24]. Two treatments viz., phorate 2 kg/ha and untreated check were taken. The experiment was laid out in paired plot method as suggested by Le Clerc (1971) [11] and both treatments replicated fifteen times. All agronomical practices viz., weeding, hoeing, irrigation etc. were performed as and when required. Observations on Initial nematode population, root-knot index at harvest, final nematode population/100cc soil and yield q/ha were recorded.
(i) Collection and processing of samples
Soil samples were collected from each experimental plot, labelled properly and brought to the laboratory and kept in refrigerator till processing. Soil samples were processed by using Cobb’s Sieving and Decanting Technique (Cobb, 1918) followed by Baermann’s Funnel Assembly Technique (Christie and Perry, 1951) \(^1\). Processed samples were thoroughly examined under microscope to estimate population of test nematode. However, for root population, soil samples were soaked in water, rinsed gently to remove adhering soil particles and stained with 0.1% acid fuchsin lactophenol solution at 80ºC for 2-3 minutes (Mc Beth et al., 1941) \(^1\) and kept in clear lactophenol at least for 24 hours.

(ii) Counting of galls and egg masses per plant
After harvesting, root samples were collected from each experimental plot, labelled properly and brought to the laboratory. Roots were gently washed in running tap water to remove adhering soil particles. Well cleaned were taken and observed thoroughly under magnifying glass for counting of galls and egg masses.

(iii) Counting of eggs and larvae per egg mass
After counting of galls and egg masses, roots were stained with 0.1% acid fuchsin lactophenol solution, rinsed in water to remove excess amount of stain and kept in clear lactophenol at least for 24 hours before examination. Egg masses were randomly selected and detached from stained roots and put in a drop of clear lactophenol on glass slide, covered with cover slip and press gently so that contents of egg mass spread thoroughly. Thereafter, eggs and larvae were counted with the help of telecounter under stereoscopic binocular microscope.

(iv) Identification of root-knot nematode species
Root samples collected from experimental field, were brought to the laboratory and washed carefully in running tap water to remove adhering soil particles. Egg masses with females were detached from roots with the help of teasing needle and forceps under stereoscopic binocular microscope. Egg masses were kept in water for 24 hours for hatching and females were picked up for identification of species. Posterior cuticular patterns of these females were cut with the help of scaples and the body contents were removed gently with camel brush No. 1 (Taylor and Netscher, 1974) \(^2\). Observation of such several pattern were recorded and the nematode species was identified as *M. incognita* (Eisenback et al., 1981) \(^6\).

(v) Root-knot index (RKI)
Root-knot index was carried out as suggested by Johnson and Campbell (1980) \(^10\).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Root-Knot Index (RKI) at harvest</th>
<th>Final nematode population (FNP)/100cc soil</th>
<th>Yield (q/ha)</th>
<th>Avoidable loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st Year</td>
<td>2nd Year</td>
<td>Pooled</td>
<td>1st Year</td>
</tr>
<tr>
<td>Phorate 2 Kg a.i./ha</td>
<td>3.6</td>
<td>3.2</td>
<td>3.4</td>
<td>749.07</td>
</tr>
<tr>
<td>Untreated Check</td>
<td>4.9</td>
<td>4.7</td>
<td>4.8</td>
<td>1301.53</td>
</tr>
</tbody>
</table>

Data are average value of fifteen replications

Initial Nematode Population: 670 larvae/100 cc soil (1st Year) and 610 larvae/100 cc soil (2nd Year)

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\(^1\) Christie and Perry (1951)
\(^2\) Taylor and Netscher (1974)
\(^6\) Eisenback et al. (1981)
\(^10\) Johnson and Campbell (1980)
Table 2: Per cent change in root-knot nematode, Meloidogyne incognita parameters and yield of cluster bean

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% decrease over control</th>
<th>% increase over control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FNP</td>
<td>RKI</td>
</tr>
<tr>
<td></td>
<td>I(^{\text{st}}) Year</td>
<td>II(^{\text{nd}}) Year</td>
</tr>
<tr>
<td>Phorate 2 Kg a.i./ha</td>
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</tbody>
</table>

**Result and Discussion**

An investigation was carried out at farmer’s field having light textured soil to estimate the avoidable losses caused by root-knot nematode, *M. incognita* on cluster bean (var. RGC-936) with the soil application of Phorate at 2 kg per ha. Observation on initial nematode population, root-knot index, final nematode population/100cc soil and yield q/ha were recorded.

Results presented in table showed that 3.4 root-knot index was recorded with phorate at 2 kg per hectare over untreated check (4.8). Results also explicit that phorate at 2 kg per hectare significantly decreased final nematode population per 100cc soil (695.80) over untreated check (1276.33). These results are in agreement with the findings of Shaukat et al. (2010) who reported minimum nematode population of root-knot nematode, *M. incognita* with carbofuran applied as soil treatment in cluster bean. Similarly, Sumita and Das (2014) found that application of carbofuran at 1 kg per hectare was very effective in reducing the galls, egg masses and soil nematode population in green gram infected with root-knot nematode, *M. incognita*.

Results revealed that soil application of phorate at 2 kg per hectare in root-knot infested field significantly enhanced the yield of cluster bean (11.94 q/ha) over untreated check (6.82 q/ha). Application of chemical increased 75.07 per cent yield of cluster bean infected with *M. incognita*. Data presented in table-1 and figure indicated that the avoidable loss due to root-knot nematode, *M. incognita* was recorded 42.88 per cent. These results are in agreement with the findings of Sharma and Baheti (1992), Jain et al. (1994), Deka and Rahman (1997), Jain et al. (2007) and Singh and Kumar (2015).

Sharma and Baheti (1992) conducted field trials to estimate losses caused by root-knot nematode, *M. incognita* and *M. javanica* on pea, okra, tomato and bottle gourd and reported 46.0, 46.7, 47.8 and 55.4 per cent losses, respectively. Jain et al. (1994) reported 71.9 per cent avoidable yield losses in tomato due to *M. incognita*. Similarly, Deka and Rahman (1997) assessed 15.05 % and 21.58 % avoidable yield losses in okra during 1995 and 1996, respectively due to root-knot nematode, *M. incognita*. Jain et al. (2007) estimated annual yield losses on okra (14.1%), brinjal (16.67%), chilli (12.05%), tomato (27.21%) and cucurbits (18.2%) due to root-knot nematode, *Meloidogyne incognita* in different agro-ecological conditions of India. Singh and Kumar (2015) also assessed yield losses caused by root-knot nematode and observed 43% in eggplant, 40% in tomato, 38% in okra and 35% in bottle gourd. This study showed that *M. incognita* cause highly per cent loss in cluster bean. This may be to environmental condition, cropping pattern, crop variety etc.

**References**

2. Christie JR, Perry VG. Removing nematodes from soil.


