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Assessment of Avoidable Yield Loss Due to Root Knot Nematode, *Meloidogyne incognita* Infesting Ridge Gourd, *Luffa acutangula* (L.) Roxb

R. K. Waykule[1*], P. R. Palande[2] and P. K. Waykule[3*]

[1]*Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India*
[2]*Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India*
[3]*Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.S., India*

**Corresponding author*

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A B S T R A C T

The field experiment was conducted to assess the avoidable yield loss due to root knot nematode in ridge gourd (*cv.* Konkan Harita) with two treatments including an untreated control. In treated treatment, carbofuran 3 G was applied in the soil @ 2 kga.i./ha. The observations on soil nematode population per plot, number of root galls/egg masses and yield per plot at termination of the experiment were recorded. The results indicated that the avoidable loss in the yield of ridge gourd was recorded to be 21.10 per cent, when the crop was treated with carbofuran 3 G at 2 kga.i./ha. The avoidable loss in the yield of ridge gourd ranged from 16.32 to 28.64 per cent.

Introduction

Ridge gourd, *Luffa acutangula* is an important vegetable crop that belongs to the family cucurbitaceae. The name to the genus "*Luffa*" has been derived from a gelatenous principle containing in ridge gourd called "loofein". Cucurbitaceous vegetables constitute a major group in vegetable production in the world. Amongst the cucurbits, ridge gourd is the most commonly preferred vegetable by the Indian people. In India, ridge gourd is grown in an area of about 10,040 ha. with a production of 1,28,310 tonnes and productivity of 12.78 t/ha. Many varieties of ridge gourd have been developed for commercial cultivation in India, which include varieties like Pusa Nasdar, Desi Chaitali, Co-1, Co-2, PKM 1, Phule Sucheta, Konkan Harita, Arka Summet, Arka Sujath, Neeta and Anitha (Anonymous, 2012-13).

The root-knot nematode, *Meloidogyne* spp. is one of the major constraint in vegetable production. It causes an annual monetary loss to the tune of Rs. 547.50 million in cucurbits (Jain *et al.*, 2007). The

host range of root-knot nematodes is extensive and more than two thousand plant species have been reported as hosts for this nematode (Sasser, 1980). This nematode is sedentary endoparasite and produce disease symptoms both on above and below ground plant parts. The symptoms are often mistaken for macro or micro nutrient deficiency or moisture stress. Foliar symptoms include stunting, premature wilting, and leaf chlorosis and below ground symptoms include root galls or knots on the roots, which affect nutrient uptake by plant. The root-knot nematodes causes severe damage thus leads to dramatic yield losses up to 24 per cent (Sikora and Fernandez, 2005).

Materials and Methods

A statistically designed experiment was conducted during *kharif* season of the year 2019 in naturally infested soil with root-knot nematode in the field plots of AICRP on Nematodes in Agriculture, Department of Agril. Entomology, M.P.K.V., Rahuri.

In field plots the seeds of ridge gourd *cv.* Konkan Harita were sown by following the recommended agronomic practices. Only one plant was maintained at each hill.

Details of experiment

a. Design : Paired Plot Design

b. Replications : Ten

c. Treatments : Two

T_1 = Treated with Carbofuran 3 G at 2 kga.i./ha

T_2 = Untreated control

d. Spacing : 1.5 m x 1 m

e. Plot size : 6 m x 3 m

f. Method of sowing : Dibbling

g. Date of sowing : 20/07/2019

h. Date of termination : 10/12/2019

i. Fertilizers:

i. Urea @100 kg N /ha

ii. Single super phosphate @50 kg P_2O_5/ha

iii. Murate of potash @ 50kg K_2O/ha

Nematicide/insecticide

The quantity of carbofuran 3 G required per plot was 120 g. The spot application of nematicide in the soil with the help of khurpi and then sowing was done in the plots.

Method of recording observations

Pre and post treatment sampling of the soil was done from the individual field plots to count the nematode population before the commencement and at termination of the experiment. Composite soil sample (200g) were collected from each field plot at the time of each observation and were processed by Cobb's Sieving and Decanting Method in laboratory. The residues of 200 and 350 mesh sieves were collected in plastic beaker and volume of beaker was adjusted to 200 ml by adding tap water.

For nematode count, the average of 10 counts of 1 ml solution was recorded and from this it was calculated to 200 ml of solution. From these observations percent decrease in nematode population was worked out.

Out of 6 plants in each plot, five plants were selected and uprooted at the time of termination of the experiment and washed under clean tap water to remove the adhering soil particles to the roots. Number of root galls and egg masses on roots per plant were recorded and gall indices 1 to 5 scale as given in Table 1 were worked out. From these observations per cent decrease in gall index over an

untreated control was worked out. The ridge gourd yield from the field plots at each picking at one week interval from first picking up to termination was recorded and expressed in kilograms per plot. From these observations the percent loss in yield in an untreated control was ascertained.

Analysis of the experimental data

The data obtained were subjected to statistical analysis for 't' test to find out the significant difference between two treatments.

Results and Discussion

The field experiment was conducted to assess the avoidable yield loss due to root-knot nematode in ridge gourd (cv. Konkan Harita) by soil application of carbofuran 3 G @ 2 kga.i./ha.

The observations on soil nematode population per plot, number of root galls/egg masses and yield per plot at termination of the experiment were recorded and presented in Table 2 to 4.

The initial root-knot nematode population was non significant and it ranged from 420 to 680 nematodes (J_2)/200 cm^3 of soil in field plots. The highly significant differences in soil root-knot nematode population, number of root galls/egg masses and gall index between treated and an untreated plots were observed at termination of the experiment. The reduction in soil root-knot nematode population, number of root galls/egg masses and gall index per plant in treated plots ranged from 47.76 to 72.00, 51.42 to 70.37 and 20.00 to 38.00 per cent, respectively. However, the average reduction in these observations from various replications of treated plots was 59.34, 60.82 and 27.60 per cent, respectively. It could also be seen from the Table 4 that the yield recorded in treated and an untreated plots were 152.55 q/ha and 120.29 q/ha, respectively. The loss in yield of ridge gourd in untreated plots ranged from 16.23 to 28.64 per cent. However, the average loss of 21.10 per cent in the yield of ridge gourd was recorded in the untreated plots, when the treated plots were treated with carbofuran 3 G @ 2 kga.i./ha.

Mote and Mhase (1997) also reported 36.45 per cent avoidable loss in yield of bitter gourd due to root knot nematode when the crop was treated with carbofuran 3G @ 2 kg a. i./ha.

The results are in agreement with Pande and Nayak (2018) who reported 74.52 per cent avoidable yield loss in ridge gourd due to root knot nematode when crop was treated with Furadon 3G @ 2 kg a. i./ha thus the results were found to be similar to findings.

The results are also in accordance with Darekar and Mhase (1988) recorded 46.92, 32.73 and 36.72 per cent loss in yield of tomato, brinjal and bitter gourd, respectively due to root-knot nematode, *M. incognita* when the crops were treated with aldicarb 10 G or carbofuran 3 G @ 6 kga.i./ha. Shendge *et al.*, (2010a) also conducted micro plot experiment to assess the avoidable yield loss in okra due to root-knot nematode, *M. incognita* and found that there was loss in yield of okra to the extent of 27.02 per cent, when the crop was treated with carbofuran 3 G @ 2 kg a.i./ha. Thus the results are in conformity with the findings.

The field experiment was conducted to assess the avoidable yield loss due to root-knot nematode in ridge gourd (cv. Konkan Harita) by soil application of carbofuran 3 G @ 2 kga.i./ha. The assessment of avoidable yield losses due to root-knot nematode in ridge gourd indicated the loss in yield of ridge gourd to 21.10 per cent under field conditions, when the crop was treated with carbofuran 3 G at 2 kga.i./ha.

Table.1 Gall index categories

Gall index	No. of root galls/egg masses/plant	Reaction
1	0	Highly resistant (HR)
2.	1 to 10	Resistant (R)
3.	11 to 30	Moderately resistant (MR)
4.	31 to 100	Susceptible (S)
5.	> 101	Highly susceptible (HS)

Table.2 Effect of nematicidal treatment on soil population of root-knot nematode, *M.incognita* infesting ridge gourd

Replication	Root- knot nematode population/ 200 cm^3 of soil				Decline in nematode population at termination (%)
	Initial		Final		
	Treated (Carbofuran 3G @ 2 kg a.i/ ha)	Untreated control	Treated (Carbofuran 3G @ 2 kg a.i/ ha)	Untreated control	
1	430	520	280	590	52.54
2	550	500	200	690	71.01
3	600	630	210	750	72.00
4	420	590	350	670	47.76
5	480	570	230	620	62.90
6	430	610	290	700	58.57
7	420	590	290	610	52.46
8	520	680	260	780	66.67
9	510	560	250	640	60.94
10	470	550	370	720	48.61
Mean	**483**	**580**	**273a**	**677**	**59.34**
't' cal	**3.79**		**15.27**		

' t' table 0.01% = 3.25

' t' table 0.05% = 2.26

a = Highly significant differences from an untreated plots according to 't' tests for paired comparison

Table.3 Effect of nematicidal treatment on number of root galls/egg masses and gall index of root-knot nematode, *M. incgonita* infesting ridge gourd

Replications	Number of root galls/egg masses/ plant at Termination		Decline in number of root galls/ egg masses at termination (%)	Gall index/plant at Termination		Decline in gall index at Termination (%)
	Treated (Carbofuran 3 G @ 2 kg a.i./ha)	Untreated Control		Treated (Carbofuran 3 G @ 2 kg a.i./ha)	Untreated Control	
1	51	115	55.65	4.0	5	20.00
2	38	126	69.84	3.3	5	34.00
3	32	108	70.37	3.1	5	38.00
4	46	103	55.34	4.0	5	20.00
5	40	111	63.96	3.4	5	32.00
6	51	117	56.41	4.0	5	20.00
7	43	100	57.00	3.5	5	30.00
8	32	102	68.63	3.1	5	38.00
9	42	104	59.61	3.4	5	32.00
10	51	105	51.42	4.0	5	20.00
Mean	**42.6a**	**109.1**	**60.82**	**3.58a**	**5.00**	**27.60**
't' cal.	**19.22**			**11.74**		

' t' table 0.01% = 3.25; ' t' table 0.05% = 2.26

a = Highly significant differences from an untreated plots according to 't' tests for paired comparison

Table.4 Effect of nematicidal treatment on yield of ridge gourd

Replications	Yield in q/ha at termination		
	Treated (Carbofuran 3 G @ 2 kg a.i./ha)	Untreated Control	Loss in Yield (%)
1	163.6	121.3	25.86
2	150.9	117.6	22.07
3	144.5	119.3	17.44
4	157.7	127.5	19.15
5	151.2	107.9	28.64
6	141.9	113.6	19.94
7	155.9	130.6	16.23
8	158.1	123.3	22.01
9	148.6	121.9	17.97
10	153.1	119.9	21.69
Mean	**152.55a**	**120.29**	**21.10**
't' cal.	**11.05**		

't' table 0.01% = 3.25; 't' table 0.05% = 2.26

a = Highly significant differences from an untreated plots according to 't' tests for paired comparison

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