Research Paper :

An ecofriendly approach to control the root knot nematode, *Meloidogyne javanica* infecting pigeonpea, *Cajanus cajan* using few organic amendments

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SUMMARY

Root – knot nemoatodes (*Meloidogyne javanica*) are economically important plant pathogens that can be managed by cultural practices, chemical nematicides and resistant cultivars. Use of nematicides for the management of root-knot nematode is being restricted due to environmental and human health concerns in addition, nematicides often do not provide long term suppression of the pathogen. Therefore, there is a need to develop alternative environmentally friendly management strategies for root – knot nematodes, including use of bio – control agents and organic amendments. Hence, the present study was carried out to find the effects of organic amendments on the growth characteristics of pigeonpea, *Cajanus cajan* infected by *Meloidogyne javanica*. The growth characteristics, such as shoot length, root length, fresh shoot weight, fresh root weight, dry shoot weight, dry root weight, and number of leaves found to be decreasing with increased inoculum levels (5,10, and 15 egg masses). These characteristics were found to be increasing with increasing percentages of organic amendments. In contradictory, the root gall index was found to be increasing with increasing inoculum levels.

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The root-knot nematodes (*Meloidogyne javanica*) are sedentary endoparasites and are among the most damaging agricultural pests attacking a wide range of crops. Due to problems caused by chemical control, mainly their deleterious effects on human health and environment, the development of alternative control methods is of great importance. *Trichoderma* spp. have been widely studied as a biological control agent against microbial diseases of crops (Sahebani and Hadavi, 2008). Oka *et al.* (2007) suggested that control of soil borne disease, including plant parasitic nematodes in organic farming systems is difficult because effective control methods and monitoring systems are not available compared to foliar diseases and insect pests. In Israel, organic farmers have struggled to control plant diseases and pests by using compounds permitted by the authorities including natural enemies and physical and cultural control methods. Soil solarization has been developed as a physical control method and has been used to control soil borne diseases and weeds.

MATERIALS AND METHODS

The nematicidal effect of organic amendments has been studied against the root knot nematode, *Meloidogyne javanica* affecting the pigeonpea (*Cajanus cajan*). *Cajanus cajan* is very heat-tolerant plant and prefers hot moist conditions. Under Hawaiian conditions it grows between 18 and 30°C and grows at temperature above 35°C under adequate soil conditions of moisture and fertility.

Collection of egg masses:

The egg masses of the root-knot nematode, *Meloidogyne javanica* were separated from the root galls of infected plants of *Acalypha indica* collected from the village of Thambipatti near Srivilliputtur town.

Preparation of sand soil mixture:

River soil, garden soil and red soil were sieved through 30 mesh sieve separately to remove the coarse particles. These soils were mixed in the proportion of 2:1:1 (river soil, garden soil and red soil) to facilitate the penetration of larvae of nematode easily and to give a favourable medium for the growth of the root system. The sand soil mixture was moistened with water and sterilized in the autoclave by placing the sand-soil mixture in the containers of the autoclave. The sterilization was carried out at 20 pounds pressure for 2 hours to destroy the various bacterial and other pathogenic organisms and their spores. After this process, the sand soil mixture was aerated overnight and transformed into a container to prevent dust contamination from air.

Preparation of organic amendments:

The organic amendments were prepared by using five selected plants like *Adhatoda vasica, Vitex negundo, Leucas aspera, Annona squamosa* and *Carica papaya*. These plants leaves were collected and shade dried. The dried leaves were powdered using mixer grinder and sieved thoroughly to get nice particles of powder. About 1 kg of sieved powder was mixed with 5 liter of cow urine uniformly. These mixtures were taken in a mud pot and tightly covered. Then this set up was buried in the soil at the depth of 1 meter for 14 days continuously. After this, the mixture was added with water and prepared in three concentrations (10%, 20% and 30%).

Inoculation of pathogen:

The experimental host plants were inoculated with the different levels (5, 10 and 15 egg masses) of the nematode by pouring into four holes made around the root zone of the plant. These holes were closed with top soil. Distilled water was added thrice in week. One set of plants was kept uninoculated to serve as control. Each treatment was replicated three times.

Application of organic amendments:

One week after inoculation, the prepared mixture of organic amendments was powder for sixty days very nearer to the roots of experimental plant at various percentages.

Analysis of growth characters:

After 60 days of treatment, the plants were removed by using tap water and washed carefully with distilled water without causing any damage to the root system, and then the following growth characters were analyzed for :

- Shoot length
- Root length
- Fresh weight of shoot and root
- Dry weight of shoot and root
- Shoot and root length was measured by using scale.
- Fresh and dry weight of shoot and root was measured by using electronic balance.

Statistical analysis:

The efficacy of the different percentages of organic amendments (10%, 20% and 30%) on *M. javanica* was analyzed statistically by observing standard deviation

RESULTS AND DISCUSSION

The present work has been carried out in the pigeonpea (*Cajanus cajan*) to study the impact of organic amendments to control the root-knot nematode (*M. javanica*). Stirling (1989) reported that the control of root-knot nematode (*M. incognita*) using organic amendments helps to increase the root and shoot length of the ginger plants than the inoculated plants and these organic amendments prevent the formation of galls in the root system. In this investigation, the various growth parameters, such as shoot length, root length, fresh and dry weights of shoot and root, total leaf area, root gall index were observed the results presented. In the control plants the shoot length was 58.52±0.44 while in the inoculated control plants the shoot length was found to be decreasing from 55.37±0.55 (5 egg mass inoculum) to 54.02±0.08 (10 egg mass inoculum). The shoot length was found to be increasing with increasing percentages of the organic amendments from 62.38±0.54, 63.66±0.57 and 66.05±0.09 at different percentage of amendments on 5% egg mass inoculum level. The same trend was observed in 15 egg mass inoculum level and also the root length was 22.17±0.99 (10%) to 24.36±0.56 (30%). The root length of the control plants was observed as 26.63±0.33 while in inoculated control plants it was found to be decreasing to 22.33±o.58 (5 egg mass inoculum), 22.06±0.60 (10 egg mass inoculum) and 20.37±0.54 (15 egg mass inoculum). The increasing trend was observed in the plants inoculated with 5, 10 and 15 egg masses with increasing percentages of organic amendments (Table 1). James and Rajan (2004) reported the efficacy of seed extract of Nerium (*Thevetia neriifolia*) in increasing the shoot length and ear head length of green gram and reduction in gall formation.

Table 1 : Measurement of shoot and root length of *Cajanus cajan* after the application of organic amendments against root-knot nematode, *M. javanica*

Inoculum level of egg masses	Shoot length (cm)					Root length (cm)				
	Control	Inoculated control	10 %	20 %	30 %	Control	Inoculated control	10 %	20 %	30 %
5	58.52	55.37±0.55	62.38±0.55	63.66±0.57	66.05±0.09	26.63±0.3	22.33±0.58	23.01±0.13	24.03±0.12	25.33±0.58
10	±0.44	54.02±0.08	54.04±0.72	56.46±0.08	58.66±0.57	3	22.06±0.60	23.83±0.62	23.89±0.33	24.29±0.61
15		48.64±0.57	52.42±0.58	53.76±0.53	54.46±0.55		20.37±0.55	22.17±0.99	23.96±0.17	24.36±0.56

Note: Data are the average value of three replications

The fresh and dry shoot weights of the plants of pigeonpea (*Cajanus cajan*) infected with *M. javanica* and treated with different percentages of organic amendments have been found and tabulated (Table 2). When compared with control plants (9.55±0.85) the fresh shoot weight decreased with increasing egg mass inoculum levels, 6.52±0.63 (5 egg mass inoculum), 6.33±0.45 (10 egg mass inoculum) and 6.14±0.82 (15 egg mass inoculum). At increased and increasing different percentages of organic amendments, 7.31±0.37 (10%) to 8.24±0.54 (30%) at 5 egg mass inoculum level, this same great increasing fresh shoot weight was observed in other two different percentage of amendments on 10 and 15 egg mass inoculum treated level. The same trend was observed in dry shoot weight.

Table 3 shows the effect of the root-knot nematode, *M. javanica* and organic amendments on the fresh and dry root weight of pigeonpea (*Cajanus cajan*). In the control plants the fresh root weight was 6.97±0.88 while in the inoculated control plants the fresh root weight was found to be decreasing when compared with control plants. The highest fresh root weight was found on 30% organic amendments applied treatment than that of inoculated control (6.32±0.51) at 5 egg mass inoculum level. This same increasing observation was observed in other two different 10 and 15 egg mass inoculum treated level. This same trend of observation was observed in dry root weight. The same results have been obtained by Pavaraj and Rajan (2008) by using leaf extract of *A. conyzoides* on the root-knot nematode *M. incognita* infection in black gram (*Vigna mungo*). Similar results were observed by Suganya and Rajan (2009) by using leaf extract of *A. squamosa* on the root-knot nematode (*M. incognita*) infection black gram (*Vigna mungo*). The increasing trend was observed in the plants inoculated with 5 egg masses with increasing percentages of organic amendments. Vyas (2006) observed that both exo and endo-metabolites of *Xenorhabdus* isolates showed

Table 2 : Measurement of fresh and dry shoot weight of *Cajanus cajan* after the application of organic amendments against root-knot nematode, *M. javanica*

Inoculum level of egg masses	Fresh shoot weight (g)					Dry shoot weight (g)				
	Control	Inoculated control	10 %	20 %	30 %	Control	Inoculated control	10 %	20 %	30 %
5	9.55±0.85	6.52±0.63	7.31±0.37	7.32±0.86	8.24±0.54	3.78±0.67	2.39±0.65	2.39±0.38	2.59±0.79	2.66±0.49
10		6.33±0.45	7.22±0.80	7.43±0.69	8.20±0.46		2.24±0.48	2.20±0.52	2.72±0.75	3.07±0.67
15		6.14±0.82	6.63±0.39	6.84±0.66	6.97±0.88		2.19±0.97	2.14±0.32	2.38±0.21	2.75±0.41

Note: Data are the average value of three replications

Table 3 : Measurement of fresh and dry root weight of *Cajanus cajan* after the application of organic amendments against root-knot nematode, *M. javanica*

Inoculum level of egg masses	Fresh root weight (g)					Dry root weight (g)				
	Control	Inoculated control	10 %	20 %	30 %	Control	Inoculated control	10 %	20 %	30 %
5	6.97±0.88	6.32±0.51	6.52±0.63	6.64±0.69	6.72±0.18	3.77±0.33	2.04±0.14	1.05±0.36	1.14±0.08	1.23±0.17
10		5.07±0.73	5.19±0.19	5.94±0.29	6.03±0.31		1.57±0.58	0.72±0.14	0.99±0.29	1.09±0.48
15		3.59±0.14	3.79±0.56	3.85±0.43	4.09±0.66		1.26±0.16	0.38±0.06	0.65±0.12	1.05±0.41

Note: Data are the average value of three replications

suppressive effects against *M. javanica* and *M. incognita* pt.2 on tomato, indicating over all improvement in plant growth parameters with significantly less root-knot index over control. The organic amendments has a remarkable nemeticidal property on *Meloidogyne javanica*.

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