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INTEGRATED MANAGEMENT OF *ROTYLENCHULUS RENIFORMIS* BY GREEN MANURING AND *PAECILOMYCES LILACINUS*

by
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Summary. *Paecilomyces lilacinus* and green manuring of *Zea mays* and *Sesbania aculeata* were used for the management of *Rotylenchulus reniformis* on pigeonpea. Application of *P. lilacinus* was found to be the best, followed by amendment of soil by *S. aculeata* and *Z. mays*. The *P. lilacinus* in combination with *S. aculeata* or with *S. aculeata* and *Z. mays* was found to be highly effective for the management of *R. reniformis*. Use of *S. aculeata* and *Z. mays* together as green manuring was found to be less effective.

Pigeonpea, *Cajanus cajan* (L.) Millsp. is an economically important pulse crop in India. It is susceptible to *Rotylenchulus reniformis* Linford *et* Oliveira which causes severe damage with poor growth and marked symptoms of chlorosis under field conditions. Green manuring has been reported to be effective for the control of plant parasitic nematodes in some countries (Bhatti, 1988; Siddiqui and Mahmood, 1993a). Several plants have been found to contain nematotoxic principles and have been used to control plant nematodes (Gommers, 1972; Sangwan *et al.*, 1985; Bhatti, 1988). The fungus *Paecilomyces lilacinus* (Thoms.) Samson has been reported to reduce nematode population densities (Jatala, 1986; Siddiqui and Mahmood, 1992, 1993b) by parasitizing females and eggs.

In the present study, control of *R. reniformis* on pigeonpea was investigated using green manuring with maize, *Zea mays* L., and *Sesbania aculeata* Pers in combination with *P. lilacinus*.

Materials and methods

Ten grams of freshly chopped leaves of maize or *S. aculeata* were added to 1 kg steam sterilized soil in 15 cm diameter earthen pots. Pots were watered daily and after one month, 5 pigeonpea seeds of cv. UPAAS-120 were sown in each pot. Before sowing the seeds were surface sterilized with 0.1% mercuric chloride and washed three times in distilled water. The seeds were then treated with pigeonpea strain of *Rhizobium*. After germination only one seedling per pot was maintained. *P. lilacinus* was cultured in Richards liquid medium for 15 days at 25 °C. The mycelium in 10 g quantities was macerated in 100 ml distilled water and 10 ml suspension was inoculated at the base of 1 week old seedlings to provide 1 g mycelium per pot. The population of *R. reniformis* was multiplied on castor plant (*Ricinus communis* L.). Specimens for the inoculum were obtained from the soil by Cobb's sieving and decanting technique followed by Baerman funnel (Southey, 1986). The nematodes were kept in an incubator at 25 °C for one week with the water changed every 24 hrs when immature females of *R. reniformis* were collected. Each pot was inoculated with 2000 immature females of *R. reniformis* in the root zone of the seedlings. There were eight treatments of managements agents (Table I); each of these treatments was tested with *R. reniformis* and a control (not inoculated with *R. reniformis*). In total there were 16 treatments and each was replicated four times. Pots were randomly distributed on a glass house bench and watering was undertaken as required.

Ninety days after inoculation with *R. reniformis*, the experiment was terminated; plant height, dry shoot weight, number of nodules and nematode density was recorded. Nematodes were extracted from soil by Cobb's sieving and decanting technique followed by Baermann funnel. Females in roots were stained in cotton-blue lactophenol and counted using a stereomicroscope. Egg-masses were hand picked and placed in a solution of sodium hypochlorite, then poured on to a 400 mesh sieve from which eggs were recovered and counted. Data were analysed statistically by multifactorial analysis and critical difference were calculated at P = 0.05.

Results

Plant height was significantly increased by treatments with green manures of *Z. mays* and *S. aculeata* together or

TABLE I - *Integrated management of* Rotylenchulus reniformis *by green manuring and* Paecilomyces lilacinus *on pigeonpea.*

Treatment		Plant length (cm)	Shoot dry weight (g)	No. of nodules	Nematode population in 100 g soil
Uninoculated control		75.6	3.44	25	–
Paecilomyces lilacinus		76.2	3.50	26	–
Zea mays		76.9	3.56	27	–
Sesbania aculeata		77.1	3.64	24	–
P. lilacinus + *Z. mays*		77.2	3.70	28	–
P. lilacinus + *S. aculeata*		77.4	3.71	30	–
Z. mays + *S. aculeata*		77.6	3.63	26	–
P. lilacinus + *Z. mays* + *S. aculeata*		77.7	3.72	31	–
R. reniformis inoculated	Control	56.2	2.18	14	22.8
	P. lilacinus	66.4	3.04	20	12.6
	Z. mays	61.9	2.51	18	15.1
	S. aculeata	63.8	2.79	22	14.0
	P. lilacinus + *Z. mays*	72.2	3.19	24	8.3
	P. lilacinus + *S. aculeata*	74.9	3.38	27	6.9
	Z. mays + *S. aculeata*	69.6	2.81	21	10.2
	P. lilacinus + *Z. mays* + *S. aculeata*	76.2	3.46	29	6.1
C.D. 5%		1.9	0.22	4.3	0.9

P. lilacinus with *Z. mays* and *S. aculeata* compared with untreated and uninoculated plants, while use of *P. lilacinus* with *Z. mays* or with *S. aculeata* or with both green manures resulted in a significant increase in shoot dry weight (Table I). A significant increase in nodulation of uninoculated plants was observed when plants were treated with *P. lilacinus* along with *S. aculeata* or *P. lilacinus* with both green manures. Moreover, inoculation of *R. reniformis* resulted in a significant decrease in plant height, shoot dry weight and nodulation over untreated uninoculated plants (Table I).

When plants inoculated with *R. reniformis* were treated with *P. lilacinus* or green manures of *Z. mays* and *S. aculeata* alone or in combination there was a significant increase in plant height and shoot dry weight. *P. lilacinus* alone produced the best increase in plant height and shoot dry weight compared with nematode inoculated plants followed by *S. aculeata* and *Z. mays*. *P. lilacinus* with *S. aculeata* or *P. lilacinus* with both green manures were equally effective in increasing plant height and shoot dry weight, while combined application of *Z. mays* and *S. aculeata* the least. Treatment of *P. lilacinus* and green manures either alone or in combination to nematode inoculated plants caused significant increase in nodulation except when *Z. mays* was used alone (Table I).

The largest increase in nematode multiplication occurred when *P. lilacinus* with *S. aculeata* or *P. lilacinus* with both green manures were used (Table I). Individually *P. lilacinus* resulted in a large reduction in nematode multiplication followed by *S. aculeata* and *Z. mays*. Combined application of both green manures resulted in least reduction in nematode multiplication compared with other combined treatments (Table I).

Discussion

Paecilomyces lilacinus parasitized eggs and females of *R. reniformis*, resulting in improved plant growth of nematode infected plants. *P. lilacinus* infected eggs of *R. reniformis* more frequently than females and destroyed the embryo within 10 days. The females were found to parasitize through the anus. Similar parasitism of nematodes by *P. lilacinus* has been observed by others (Jatala, 1986; Siddiqui and Mahmood, 1993b). Green manuring suppress nematode populations by increasing organic matter and fa-

vouring natural enemies, besides improving crop tolerance. Green manuring with *S. aculeata* was more effective than *Z. mays* in suppressing nematode populations by improving plant growth. Integrated use of *P. lilacinus* with *S. aculeata* will be more effective than *P. lilacinus* when used with both green manures. *P. lilacinus* is reported to multiply on leaves of neem (Zaki and Bhatti, 1988). Application of *S. aculeata* with *P. lilacinus* probably improved the multiplication of *P. lilacinus* resulting in high nematode suppression.

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