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Assessment on potential of bacterial biocontrol agents on plant parasitic nematodes in banana

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Abstract

Field experiments on management of nematodes in banana was conducted to assess the efficacy of plant growth promoting rhizobacteria, single and combined application of *Pseudomonas fluorescens* and *Bacillus subtilis*. All the treatments were significantly increased the yield parameters viz., stem girth, plant height and number of leaves per plant and observed that the reduction of nematode population in root system. Eighty-six per cent of nematode population was reduced from the initial nematode population recorded in combined application of *P. fluorescens* (Pfbv 22) + *B. subtilis* (Bbv57) each 12.5 g/plant respectively compared to untreated control followed by single soil application of *P. fluorescens* (Pf1) @ 25/ plant recorded lowest nematode population compared to untreated control.

Keywords: bacterial biocontrol agents, plant parasitic nematodes, banana

Introduction

Banana is one of the important fruit crops in Tamil Nadu cultivated across the state. In recent years, the focused cultivation of banana on a commercial scale is threatened by biotic and abiotic stress. Among the biotic stresses, plant parasitic nematodes pose a frightening challenge for banana cultivation. The plant parasitic nematode of major concern in banana production throughout the world is the burrowing nematode, *Radopholus similis* (Cobb) Thorne. Other nematode species that frequently cohabit in mixed populations with burrowing nematode, such as lesion nematode (*Pratylenchus coffea*), spiral nematode (*Helicotylenchus multicinctus*) and *Meloidogyne incognita* are also regarded as a contributing factor to overall nematode losses. Nematodes attack root and corm tissues causing damage that can result in lengthening of the vegetative growth, production of small bunches and toppling of the plants in severe conditions. The management of nematode pests relies mainly on the repeated use of nematicides which has many drawbacks such as the residue in fruits, groundwater contamination and effect on non-target organisms. So as to avoid these problems, biological agents were used to manage plant parasitic nematodes in banana. The present study was undertaken to evaluate the biocontrol potential of talk formulation viz., *Pseudomonas fluorescens* and *Bacillus subtilis* in the management of nematodes under field condition.

Materials and Methods

The talk formulation of plant growth promoting rhizobacteria (PGPR) *P. fluorescens* and *B. subtilis* were tested for their antinemic potential against plant parasitic nematodes on banana under field condition. The talk formulation of PGPR consortium is the combination of two bacterial strain *Pseudomonas fluorescens* (Pfbv 22) and *Bacillus subtilis* (Bbv57) developed by Jonathan (2008) Department of Nematology, Directorate of Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore was used in this experiment. Two field trails were conducted in nematode sick farmer's field during 2015-16. The banana suckers were planted in the field after application of biocontrol as per the treatment scheduled viz., Soil application of

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P. fluorescens (Pfbv 22) @ 25g/plant, *B. subtilis* (Bbv57) @ 25 g/plant, *P. fluorescens* (Pfbv 22) + *B. subtilis* (Bbv57) each 12.5 g/plant, *P. fluorescens* (Pf 1) @ 25 g/plant, Carbofuran 3G @ 1 kg a.i./ha, along with untreated control. The experiment was laid out in randomized block design with six treatment and four replications. The experiment was terminated after harvest. Observation such as soil nematode population before and after treatment, nematode incidence (%), number of leaves per plant, stem girth and plant height were also recorded at the time of termination of experiment.

Results and Discussion

The results revealed that in all the treatments were significantly reduced the nematode population and plant growth parameters were increased considerably compared to untreated control. Among the treatments soil application of *P. fluorescens* (Pf1) @ 25g/plant and combined application of *P. fluorescens* (Pfbv 22) + *B. subtilis* (Bbv57) each 12.5 g/plant recorded lowest nematode population 86 per cent compared to untreated control. Consortium of both *P. fluorescens* and *B. subtilis* found to reduce nematode disease incidence of 14.5 per cent compared to untreated control. Whereas application

of *P. fluorescens* (Pfbv 22) + *B. subtilis* (Bbv57) each 12.5 g/plant found to increase the stem girth, plant height and number of leaves/plant significantly from untreated control. In general, these bioagents is capable of reducing the nematode population in soil, compared to untreated control. The population of nematodes juveniles was suppressed by *Pseudomonas* spp. due to its nematicidal action against juveniles (Keuken and Sikora, 1995) ^[1], and alteration of root exudates, which affect the hatching and mortality of juveniles (Oostendorp and Sikora, 1990) ^[2] finally nematode population were reduced and increased the plant growth significantly (Santhi and Sivakumar, 1995) ^[3] and the bacterium was suited for both seed as well as soil application, because of their potential for rapid and aggressive root colonization. The PGPR consortium was used as soil application in black pepper reduced the population of *M. incognita* and *Radopholus similis* significantly (Senthilkumar *et al.*, 2011) ^[4]. Hence it was concluded that combined application of *P. fluorescens* (Pfbv 22) + *B. subtilis* (Bbv57) each 12.5 g/plant may be a promising practice in management of nematodes in banana under field condition.

Table 1: Assessment of biocontrol potential on nematode management in banana

Treatments	Nematode population (200cc soil)		Stem girth	Plant height	Number of leaves	Nematode disease incidence (%)
	Before treatment	After treatment				
T1 – Soil application of <i>P. fluorescens</i> (Pfbv 22) @ 25 /plant	142	32	25.4	157	7	24.5
T2 – Soil application of <i>B. subtilis</i> (Bbv57) @ 25 g/plant	158	46	26.7	151	6	43.2
T3 –Soil application of <i>P. fluorescens</i> (Pfbv 22) + <i>B. subtilis</i> (Bbv 57) each 12.5 g/plant	144	19	28.5	161	7	14.5
T4 – Soil application <i>P. fluorescens</i> (Pf 1) @ 25 g/plant	153	26	24.8	158	7	19.5
T5 – Carbofuran @ 1 kg a.i./ha	139	31	22.4	122	6	32.7
T6 – Untreated control	133	193	19.2	115	5	100
CD (0.05)	-	-	1.44	10.31	1.17	3.87

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