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Effect of Marigold, *Tagetes erecta* Intercropped with Banana against Root-Lesion Nematode, *Pratylenchus coffeae*

P. SUNDARARAJU

Crop Protection Laboratory, National Research Centre for Banana (ICAR), Thogamalai Road, Thayanur post, Tiruchirapalli - 620102, Tamil Nadu

ABSTRACT: An experiment was conducted at farmer's field on banana cv. Nendran (AAB) infested with root-lesion nematode. Maximum reduction in root-lesion index and nematode population was noticed, where *Tagetes erecta* was grown as an intercrop and on par with chemical treatment, whereas, maximum population was recorded in untreated control plants. The yield of banana increased significantly to 12.5 and 12 kg/plant in plants treated with chemical pesticides and intercropped with *Tagetes* respectively compared to a minimum bunch weight of 7 kg per plant in untreated control plants. Though the plants treated with chemical pesticides were found to be on par with marigold grown as an intercrop, but the use of marigold as an intercrop in banana field warrants more economical and ecofreindly compared to chemical nematicides.

Key words: *Pratylenchus coffeae*, *Tagetes erecta*, monocrotophos, carbofuran, neem cake, banana, Nendran (AAB)

Banana (*Musa* spp.), the most important fruit crop grown in India ranked second, next to mango, in area and production. Plant parasitic nematodes are widespread and are the most important pests of banana. Crop losses caused by nematodes in bananas are very high, with an average annual yield losses estimated at about 20 per cent world wide (Sasser & Freckman, 1987). The root-lesion nematode, *Pratylenchus coffeae* is one of the most important nematode pests of banana next only to the burrowing nematode, *Radopholus similis*. In India, losses caused due to root-lesion nematodes on banana cv. Nendran was estimated at about 44.4% (Sundararaju & Cannayane, 2003). In recent years due to prohibitive cost of pesticides and their toxicity to human beings and soil flora, considerable attention has been paid towards the control of nematode diseases by the use of botanicals. Intercropping of various nematicidal plants viz. sunhemp, sesamum, mustard, marigold etc. have been reported to be effective against nematodes infecting several crops (Boride *et al.* 1970). As there was no such report on control of root-lesion nematode infected banana plants, the present investigation was carried out to find out the appropriate combination of growing marigold as an intercrop in banana field and its effect on plant growth, yield and nematode populations.

MATERIALS AND METHODS

The experiment was carried out during 2001-02 in root-lesion nematode infested banana cv. Nendran at farmers field, Nachikurichy, Trichirappalli, Tamil Nadu where soil population density of *P. coffeae* was more than the economic threshold level (> 1 nematodes/g soil). Healthy suckers of uniform size, weighing about 1 kg each were pared to a depth of one cm to remove the superficial tissues and planted in the field at a spacing of 1.8 x 1.8m. The experiment was arranged as a Completely Randomised Block Design (CRBD) with five replications at the rate of 8 plants per replication of seven treatments. The seeds of marigold plants *Tagetes erecta* were sown between two banana beds (vertical and horizontal row) as well as in the entire area of banana plants including basin. In comparison, the recommended practice of paring the suckers and dipping them in Monocrotophos 36 EC at 0.05% at the time of planting and Carbofuran 3G @ 40g per plant in 3rd and 6th month after planting (MAP) was imposed. Organic amendment like neem cake was also used as one of the treatments.

The treatments imposed were: T1- Banana + Marigold (vertical row); T2- Banana + Marigold (horizontal row); T3- Banana + Marigold (entire area of the field); T4-

Banana + Neem cake @500g at 3rd and 6th MAP; T5- Banana + Monocrotophos dip at the time of planting; T6- Banana + Monocrotophos dip followed by furadon at 3rd and 6th MAP; and T7- Banana alone.

Plants were grown using recommended practices. Pre treatment soil and root samples were collected at 3rd and 6th month after planting in order to assess the nematode populations. At harvest, data on crop duration and plant growth parameters such as plant height, pseudostem girth, number of leaves and yield were recorded. Observation on root-lesion index was recorded on a 1-5 scale (Pinochet, 1988) at harvest after carefully uprooting the plants. After indexing, roots were cut into small pieces, mixed thoroughly and three aliquots of 10g each were collected from each plant. These were then stained in boiling acid fuchsin lactophenol for three minutes, cleared and macerated for 40 seconds for population counts using a warring blender. The total root population was computed with an average population per ml. Nematodes from 250 cc soil from each plant were extracted by Cobb's sieving method for estimating total soil population. The data were statistically analysed by following Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The perusal of the data presented in Table 1 revealed that all the treatments significantly increased the plant growth and yield compared to untreated control plants. Maximum plant height of 310 cm and 305 cm was recorded with respect to the treatment T6 and T3 followed by 295 cm, 290 cm and 285 cm in T2, T1 and T4 respectively compared to untreated control (T7). The treatments T6 and T3 produced maximum number of leaves (41 and 40) with psuedostem girth of 65 cm in both the treatments. Whereas, the least psuedostem girth (45 cm) and minimum number of leaves (30) were recorded in treatment T7. Marigold planted in vertical row and horizontal row (T1and T2) were on par with each other with respect to the psuedostem girth and number of leaves. The rest of the treatments were found on par with each other. It is interesting to note that minimum time taken from planting to harvest was 350 days in treatment T6 followed by 355 days in treatment T3 compared to a maximum of 400 days in control plants. Marigold planted in vertical row and horizontal row (T1 and T2) also noticed the minimum time taken from planting to harvest (361 and 360 days). Maximum bunch weight of12.5 kg

Table 1. Influence of marigold, neem cake and chemical pesticides on the plant growth, crop duration and yield of banana infected by *Pratylenchus coffeae.*

(Mean of 5 replications)

Treatments	Shoot length (cm)	Pseudostem girth (cm)	No. of leaves	Crop duration (No. of days from planting to harvest)	Bunch weight (kg)
Banana + Marigold (Vertical row)	290^{bc}	55^{bc}	37^{a}	361^{cd}	11.0^{bc}
Banana + Marigold (Horizontal row)	295^{b}	58^{bc}	38^{a}	360^{cd}	11.5^{ab}
Banana + Marigold (Entire area of field)	305^{a}	65^{a}	40^{a}	355de	12.0^{ab}
Banana + Neem cake	285^{c}	60^{ab}	38^{a}	365^{bc}	10.0^{cd}
Banana + Monocrotophos dip	270^{d}	53^{c}	36^{b}	370^{b}	9.0^{d}
Banana + Monocrotophos dip followed by Furadon at 3 and 6 MAP*	310^{a}	65^{a}	41^{a}	350^{e}	12.5^{a}
Banana alone	250^{e}	45^{d}	30^{b}	400^{a}	7.0^{e}

Means in the same column followed by the same letter do not differ significantly according to Duncan's Multiple Range Test for P<0.05%; * MAP - Month After Planting

was recorded in T6 where banana was grown by following the monochrotophos dip at the time of planting and application of furadon at 3rd and 6th month after planting. Similar to the treatment T6 the maximum bunch weight of 12 kg was recorded in T3 where marigold was grown in the entire area of banana field as intercrop. This was followed by bunch weight of 11.5 and 11kg in T2 and T1 compared to a minimum bunch weight of 7 kg in untreated control plants.

Analysis of the nematode population from soil and roots presented in Table 2 showed that all the treatments were effective in significantly reducing the population of *P. coffeae.* Initial nematode population from soil varied between 185 and 230/250cc of soil. Following the application of furadon, neem cake and marigold grown as an intercrop, drastic reduction in nematode population and root-lesion index was noticed in all the treatments at 3rd and· 6th month after planting compared to untreated control. At the time of harvest, the minimum root-lesion index (1.2 and 1.6) with least nematode population of 20 and 25/g of root was recorded in treatment T6 and T3 respectively, followed by T2 and T1 recording the minimum root-lesion index (1.8 and 2.0) with the least nematode population of 30 and 35/g of root, respectively. The rest of the treatments were on par with each other whereas the maximum root-lesion index (5.0) and maximum nematode population (224/g of root) was recorded in untreated control plants.

It is, therefore, apparent that growing marigold as an intercrop either in entire area or vertical/horizontal rows was the most effective treatment and on par with the chemical treatment of monocrotophos dip followed by the application of furadon in improving the plant growth, fruit yield and in reducing the nematode population and root-lesion index. Though, the plants treated with chemical pesticides were found to be on par with marigold grown as an intercrop, but the use of marigold as an intercrop in banana field warrants more economical and ecofreindly compared to chemical nematicides. The present investigations are in agreement with earlier workers (Daulton & Curtis, 1963; Dhangar *et al.,* 1995; 2002) who reported that better plant growth and reduction in root-knot index and nematode populations in brinjal intercropped with marigold. Intercropping of banana with

Table 2. Influence of marigold, neem cake and chemical pesticides on the root-lesion index and population build up of *Pratylenchus coffeae* on banana

(Mean of 5 replications)

Treatments	Initial population (250 cc soil)	Pre-treatment nematode population at 3rd MAP**		Pre-treatment nematode population at 6th MAP		Root lesion index (1-5) scale*	Final nematode population at harvest	
		Soil	Root	Soil	Root		Soil	Root
Banana + Marigold (Vertical row)	225^{ab}	135^{bc}	110^{d}	105^{cd}	85^{d}	2.0^{d}	65^{d}	35^{d}
Banana + Marigold (Horizontal row)	220^{bc}	140^{bc}	95^{e}	115^{c}	90^{c}	1.8^{de}	45^{e}	30^{de}
Banana + Marigold (Entire area of field)	230^{ab}	125^{d}	90^{e}	100^{de}	70^{de}	1.6^{e}	35^{ef}	25^{de}
Banana + Neem cake	215^{cd}	130^{cd}	125^{bc}	110^{cd}	115^{cd}	3.5^{c}	85^{c}	80^{c}
Banana + Monocrotophos dip	185^{f}	110^{e}	130^{b}	145^{b}	140^{b}	4.5^{b}	180^{b}	145^{b}
Banana + Monocrotophos dip followed by furadon at 3 and 6 MAP	195^{e}	125^{d}	120^{c}	90^{c}	75^{e}	1.2^{f}	30^{f}	20^{e}
Banana alone	210^{d}	265^{a}	145^{a}	290^{a}	160^{a}	5.0^{a}	315^{a}	224^{a}

Means in the same column followed by the same letter do not differ significantly according to Duncan's Multiple Range Test for P<0.05%

*1: No infection; 2: 5-10 lesions; 3: 11-15 lesions; 4: 16-20 lesions; 5: above 20 lesions

** MAP – Month After Planting

Crotalaria juncea was found to reduce *Radopholus similis* with improved growth and yield of banana in India (Charles & Venkitesan, 1993). Significant yield increases and reduction in *P. coffeae* populations were also recorded in banana plants treated with 50 per cent of N applied by neem cake (Sundararaju & Kumar, 2000). Previous reports also indicated that dried leaves of several plant species, when used as soil amendments, can successfully control *P. coffeae* and significantly increase the yield with reduced duration of the crop (Sundararaju 2003). The present investigation suggests the possible use of marigold (*Tagetes erecta*) as an intercrop in banana field to enhance the production and productivity of banana as well as for the control of plant parasitic nematodes.

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