

Effect of *Pseudomonas fluorescens* and organic manures for the management of coconut eriophyid mite

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Abstract: Experiments were conducted at Tamil Nadu Agricultural University and farmer's holding to assess the effect of bacterial biocontrol agent *Pseudomonas fluorescens*, and organic manures like biofertilizers, neem cake, farm yard manure and TNAU nutrient mixture. Though the application of various treatments in the soil had no significant effect on mite population and nut damage, the lowest population (0 to 0.17/4 sq.mm) was observed in *P. fluorescens* as soil application compared to untreated check (0 to 6.96/4 sq.mm). Nut damage also varied from 51.38 (*P. fluorescens*) to 83.09 per cent (biofertilizer). Application of *P. fluorescens*, neem cake and farm yard manure either alone or in combinations had no influence on the mite population and damage over a period of one year. Damage rating varied from 1.52 (neem cake + *Pseudomonas*) to 3.13 (farm yard manure). *P. fluorescens* applied at different period had no effect except on 210 days after the initial treatment where there was reduction in population due to the application irrespective of the frequency of application. However, there was no significant difference in nut damage which ranged from 1.92 in *P. fluorescens* applied once in a year to 3.63 when applied once in three months.

Key words : Eriophyid mite, Organic manures, *Pseudomonas fluorescens*.

Introduction

Coconut is a major crop of Tamil Nadu and has been cultivated in 3.52 lakh hectare. The crop is attacked by a number of insects and infecting crown, leaves and nuts resulting in severe yield loss. Among these, eriophyid mite, *Aceria guerreronis* Keifer is found to be the most serious one since 1998. The pest has been reported to cause heavy damage in coconuts in the Americas and West Africa for the past 30 years (Moore, 2000). However, management practices to contain the pest have been given importance only after entering India and Sri Lanka. Till 1998, it was considered to be a minor pest and its economic importance was felt when the pest attained epidemic form in Kerala during February, 1998 (Samma *et al.* 1998) and areas of Tamil Nadu adjoining to Kerala during August, 1998 (Saiyan *et al.* 2000). In order to find the effect of bacterial biocontrol agent, *Pseudomonas fluorescens* and organic manures experiments were conducted.

Materials and Methods

Effect of *P. fluorescens*, biofertilizers and Azoxystrobin 3G as soil application, micronutrient mixture and monocrotophos 36 SL as root

feeding was tested by laying out a trial (Trial-I) at Coconut Nursery Farm of Tamil Nadu Agricultural University (TNAU) on T x D West Coast Tall of 15 years old trees during 2000-2001. The treatments were applied thrice at an interval of two months and replicated six times.

Trial - I. Treatments

1. Soil application of *P. fluorescens* - 100g/tree (developed by the Department of Plant Pathology, TNAU). For each tree identified for the treatment, 100g of *P. fluorescens* was mixed with two kilograms of farm yard manure and applied in the basin and irrigated.
2. Soil application of biofertilizers - Azospirillum 100g + Phosphobacteria - 100g + VAM - 100g/tree (produced by the Department of Agricultural Microbiology, TNAU). Three biofertilizers were mixed with two kilograms of farm yard manure and applied in the basin and irrigated.
3. Root feeding of nutrient mixture - 250 ml/tree (developed by the Department of Crop Physiology, TNAU). Growing tip of the root cut in a slanting manner was inserted in the polyethene bag having the

Table 1. Management of coconut eriophyid mite through soil amendments and *P. fluorescens*

Treatment	Mite population no./4 sq.mm.														
	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	DAT	DAI	DAT	DAT	DAI	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT
<i>Pseudomonas</i>	2.54	6.67	0.25	0	0	0.17	0	0.08	9.38	2.21	2.33	6.04	10.63	2.42	2.92
Biofertilizer	8.96	8.25	0.21	5.42	0.42	3.75	0	4.17	0	14.79	5.96	15.13	7.5	10.29	22.71
Nutrient mixture	5.79	12.29	5.04	5.54	1.08	15.33	1.33	7.63	5.38	7.79	18.92	18.58	5.42	8.46	18.54
Carbofuran	4.29	9.42	2.83	7.96	1.58	1.92	4.42	8.96	5.46	11.92	15.5	10.67	23.13	2.71	11
Monocrotophos	13.46	9.25	7.13	7.54	0	7.92	1.25	5.25	2	19.42	9.75	12.08	10.83	6.04	13.75
Untreated check	12.33	3.79	2.42	0.79	0	3.96	1.04	6.96	6.17	9.38	21.46	9.4	9.79	12.38	16.46
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Effect of *Pseudomonas fluorescens*, biofertilizer and nutrient mixture on coconut nut damage

Treatments	Damage level (%)
<i>Pseudomonas</i> - 100 g/tree	51.38
Biofertilizer - 300 g/tree	83.09
Nutrient mixture - 250 ml/tree	75.08
Carbofuran - 250 g/tree	63.91
Monocrotophos - 15 ml/tree	71.23
Untreated check	77.78
CD	NS

nutrient solution and tied with twine. On complete absorption of the solution, trees were irrigated.

- Soil application of carbofuran 3G-250g/tree. The required quantity of insecticide granules was mixed with one kilogram of sand and applied in the basin, raked with hoe, covered with soil and irrigated.
- Root feeding of monocrotophos 15ml + water 15ml. The required quantity of insecticide and water was taken in a polyethylene bag and the growing tip of the root was given slanting cut and immersed for absorption.
- Untreated check.

The mite population in each tree was recorded from two numbers of 3-4 months old buttons. The tender portion of the perianth was sliced using a thin blade and observed for mites within 4 sq.mm window. Observations on mite population were made once in 15 days. Mite damage was recorded on mature nuts 150 days after the third round of treatments.

Based on the preliminary observation, two trials were laid out at farmer's holding on West Coast Tall of 20 years old trees (Mampalli, Coimbatore district). The trial-II was laid out to evaluate the efficacy of *P. fluorescens*, neem cake and farm yard manure and a separate trial-III to assess the frequency of application of *P. fluorescens*. The treatment details are as follows.

Trial II. Effect of *P. fluorescens* along with other organic manures

- Soil application of *P. fluorescens* at 100g per tree at bimonthly interval three times as described in the trial I.
- Soil application of neem cake 5 kg per tree at six months interval + *P. fluorescens* at 100g per tree three times.

Table 3. Influence of *P. fluorescens* and organic manures on coconut eriophyid mite

Treatment	No. of mites per 4 sq.mm (mean of 3 replications)															
	Pre-treat.	15	30	60	90	120	150	180	210	240	270	300	330	360	DAT	DAT
<i>Pseudomonas</i> (P)	25.25 (4.35)	6.67 (2.40)	7.42 (2.48)	8.92 (2.21)	1.17 (1.14)	1.83 (1.29)	1.33 (1.88)	0 (0.71)	7.33 (2.45)	0 (0.71)	0 (0.71)	5.92 (2.07)	11.25 (2.92)	0 (0.71)	DAT	DAT
Neem cake (N)	12.17 (3.45)	0 (0.71)	3.92 (1.91)	0 (0.71)	1.17 (1.14)	0 (0.71)	0.83 (1.05)	0 (0.71)	9.75 (2.65)	10.92 (2.99)	0 (0.71)	17.42 (2.89)	0 (0.71)	4.17 (1.67)	DAT	DAT
Farm yard manure (F)	8.00 (2.49)	1.83 (1.29)	0 (0.71)	0 (0.71)	2.17 (1.35)	0 (0.71)	0 (0.71)	0 (0.71)	3.58 (1.94)	1.17 (1.23)	1.08 (1.12)	4.25 (1.68)	5.83 (1.89)	0 (0.71)	DAT	DAT
N+P	22.33 (4.75)	2.25 (1.37)	4.25 (2.06)	0 (0.71)	1.67 (1.25)	1.25 (1.16)	2.17 (1.52)	3.75 (1.61)	2.33 (1.54)	5.08 (1.92)	1.33 (1.18)	7.75 (2.10)	4.67 (1.74)	0 (0.71)	DAT	DAT
F+N	3.83 (2.04)	12 (2.49)	10.67 (2.64)	0 (0.71)	7.33 (2.36)	0 (0.71)	4.42 (1.71)	0 (0.71)	5.92 (2.28)	4.42 (1.71)	0 (0.71)	8.17 (2.14)	0 (0.71)	4.50 (1.72)	DAT	DAT
F+P	7.08 (2.44)	9.67 (2.71)	1.67 (1.25)	0 (0.71)	5.17 (1.80)	6.11 (1.92)	2.75 (1.65)	0 (0.71)	9.75 (3.19)	2.42 (1.40)	5.50 (1.85)	11.00 (2.40)	6.33 (1.94)	3.83 (1.63)	DAT	DAT
F+P+N	28.75 (4.39)	3.67 (1.60)	4.58 (1.96)	2.50 (1.41)	1.75 (1.27)	7.08 (2.03)	0 (0.71)	3.75 (1.61)	3.67 (1.60)	1.83 (1.32)	10.17 (2.77)	10.33 (2.78)	0 (0.71)	3.50 (1.82)	DAT	DAT
Carbosulfan root feeding	9.17 (2.75)	20.17 (3.63)	0 (0.71)	5.17 (1.80)	3.92 (1.83)	3.33 (1.55)	3.75 (1.61)	0 (0.71)	2.25 (1.37)	4.92 (2.08)	5.00 (1.75)	0 (0.71)	1.42 (1.20)	0 (1.72)	DAT	DAT
Untreated check	34.83 (5.92)	17.42 (4.09)	7.75 (2.10)	0 (0.7)	2.17 (1.35)	0 (0.71)	0 (0.71)	4.17 (1.67)	13.83 (3.57)	10.75 (2.38)	0 (0.71)	34.92 (5.08)	1.67 (1.36)	6.33 (1.94)	DAT	DAT
CD at 0.05 = 2.12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

DAT = Days after treatment; NS = Non-Significant

3. Soil application of neem cake 5 kg per tree at six months interval as above.
 4. Soil application of farm yard manure (FYM) 50 kg per tree alone at six months interval.
 5. Soil application of FYM 50 kg + neem cake 5 kg per tree at six months interval.
 6. Soil application of FYM 50 kg per tree at six month interval and *P. fluorescens* at 100g per tree at bimonthly interval three times.
 7. Soil application of FYM 50 kg + neem cake 5 kg per tree at six months interval and *P. fluorescens* at 100g per tree at bimonthly interval three times.
 8. Standard insecticidal check carbosulfan 15ml + water 15ml root feeding at bimonthly interval - three times.
 9. Untreated check.
2. once in three months (four times)
 3. once in four months (three times)
 4. once in five months (twice)
 5. once in six months (twice)
 6. once in an year
 7. Untreated check

The required quantity of *P. fluorescens* was mixed with FYM and applied as described above and irrigated. The number of replication was five.

Observation on mite population was made once in 15 days throughout the period of study of one year in both the trials. The nut damage was graded by scoring the damage level in the scale 1-5 (Julia and Mariau, 1979) based on the intensity after 120 days of the second application of treatments.

Results and Discussion

Mite population observed at 15 days interval in trial-I is presented in the table 1. Mean population of mite in 4 square mm ranged from 0 to maximum of 22.71. Statistical analysis of the treatments revealed no significant difference at all the period of observations. However, the mite population showed remarkable reduction on 30 days after the application of *P. fluorescens* and the population was nil in the buttons from 45 days to 120 days of initial application of treatments. During the same period, population in the untreated check ranged from 0 to 6.96 per 4 sq.mm. The nut damage level assessed after five months of last application of treatments ranged from 51.38 (*P. fluorescens*) to 83.09 per cent (biofertilizer) with no significant different

Required quantity of neem cake and FYM was applied in the basin of the tree and irrigated. *P. fluorescens* was mixed with FYM and applied. In the case of root feeding of carbosulfan, the method described for monocrotophos root feeding was adopted. The trees were irrigated only after complete absorption of the insecticides. The treatments were replicated thrice.

Trial III. Field persistence of *P. fluorescens*

Formulated product was applied in the basin at different periods.

The treatments were as follows.

1. *P. fluorescens* @ 100g/tree once in two months (six times)

Table 4. Effect of organic manures on nut damage caused by coconut eriophyid mite

Treatments	Damage grading (1-5 scales)
<i>Pseudomonas</i> (P) - 100 g/tree - three times	1.67
Neem cake (N) - 5 kg/tree - once in six months	1.55
Farm yard manure (F) - 50 kg/tree - once in six months	3.13
N + P	1.52
F + N	2.13
F + P	1.85
F + P + N	2.58
Carbosulfan root feeding - 15 ml/tree - once in two months - three times	2.02
Untreated check	2.75
CD at 0.05 = 2.12	NS

Table 6. Effect of *Pseudomonas fluorescens* applied at different interval on eriophyid mite damage on nuts

Treatments	Damage grading (1-5 scales)
<i>P. fluorescens</i> - once in two months	3.21
<i>P. fluorescens</i> - once in three months	3.63
<i>P. fluorescens</i> - once in four months	2.72
<i>P. fluorescens</i> - once in five months	3.59
<i>P. fluorescens</i> - once in six months	2.48
<i>P. fluorescens</i> - once in a year	1.92
Carbosulfan root feeding - 15 ml/tree	2.57
Untreated check	2.03
CD at 0.05 = 2.12	NS-F = 2.004

of *P. fluorescens* application also, no significant effect of treatments over untreated check was observed irrespective of the frequency except only on 210 days after treatment where there was reduction population in trees received *P. fluorescens* (Table 5). However, the effect was not observed subsequently. Considering the damage rating, there was no significant difference due to the application of *P. fluorescens* at various period which ranged from 1.92 in trees received once in a year to 3.63 in trees receiving once in three months (Table 6).

The trials conducted at TNAU farms and also at farmer's holding indicated that application of any treatment in soil against mite was not effective. The low population observed due to *P. fluorescens* application on 15 years old T x D cultivar during the first trial was not noticed in the subsequent trials. This may be due to variation in response of the cultivar (West Coast Tall) and also age of the trees (>20 years). Further the trees at farmers holding were under moisture stress compared to the trees at TNAU. Muthiah and Bhaskaran (2000) reported that the mean damage grade index percentage was maximum (50%) in the chemical fertilizer (alone) treatment while least (29%) in trees applied with neem cake 2 kg + bone meal 0.5 kg + mill ash 4 kg tree/year. However the effect of neem cake could not be realized in the present trials conducted.

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