

## Effect of Integrated Management on Coconut Yield and Per Cent Reduction in Incidence of Eriophyid Mite *Acerai guerreronis* (Keifer) (Acarina : Eriophyidae)

P. B. Hegade, V. S. Desai, A. L. Narangalkar,  
 S. S. Prabhudesai, P. M. Haldankar

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**Abstract** The maximum average nut yield during year 2014-15 (125.33 nuts) was recorded in treatment, application of recommended dose of fertilizers (RDF), azadirachtin and micronutrients through briquettes ( $T_6$ ) followed by spraying with azadirachtin 1% @ 4 ml/liter of water + recommended dose of fertilizers ( $T_2$ ), drenching with eriophyid smash 250 ml/20 liter of water + recommended dose of fertilizers ( $T_3$ ), root feeding with azadirachtin 5% @ 7.5 ml + 7.5 ml water

and recommended dose of fertilizers ( $T_1$ ), application of recommended dose of fertilizers through briquettes + Neem cake 15 kg/palm/year ( $T_8$ ). During year 2015-16 the highest yield was noticed in  $T_6$  i.e., 129.50 nuts, after that  $T_2$  (122.50 nuts), ( $T_1$ ) (121.67 nuts) and ( $T_3$ ) (117.67 nuts). The pooled mean of coconut yield revealed that, the superior treatment was 127.42 nuts in ( $T_6$ ) followed by ( $T_2$ ), (121.83 nuts), ( $T_1$ ) 119.8, ( $T_3$ ) 117.83 and ( $T_8$ ) 116.58.

**Keywords** Integrated pest management, Eriophyid mite, Azadirachtin, Yield, Coconut.

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P. B. Hegade\*  
 Assistant Professor, KRMCA, Phondaghat, Dr B.S.K.K.V.,  
 Dapoli, India

V. S. Desai  
 Associate Professor, Department of Agric Entomology,  
 Dr B.S.K.K.V., Dapoli, India

A. L. Narangalkar  
 Head, Department of Agric Entomology, Dr B.S.K.K.V.,  
 Dapoli, India

S. S. Prabhudesai  
 Head, Department of Soil Science and Agric Chemistry,  
 Dr B.S.K.K.V., Dapoli, India

P. M. Haldankar  
 Associate Dean, College of Horticulture, Mulde, Dr B.S.K.K.V.,  
 Dapoli, India  
 Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli  
 (MS) 415712  
 e-mail : hegadepb 6477@gmail.com  
 \*Correspondence

### Introduction

Coconut palm, *Cocos nucifera* L. having eulogistic epithets such as Devavriksha, Kalpavriksha, tree of life, tree of abundance. It's every part and product is put to some useful purpose. Every ritual or ceremony always begins with coconut offerings. Coconut is grown in more than 93 countries worldwide. World production of coconut is 12.29 MT with a total production in terms of copra equivalent of 11.04 million MT. India ranks number one among the coconut growing countries with productivity of 10122 nuts per ha and area of about 2140.50 thousand ha with a production of 21665.19 million tons. The total area under coconut in Mharashtra is about 28000 ha with a pro-

duction of 187.47 million tons and productivity is 6676 nuts/ha [1].

Coconut is prone to various pests like rhinoceros beetle, red palm weevil, black headed caterpillar, eriophyid mite and rats. Among all the pests eriophyid mite is becoming a serious problem now a days. First time it was observed by Keifer at Mexico from Guerrero state in 1965. In India it was first reported in Ernakulam district of Kerala in 1998 at Ambalour panchayat. It was first noticed in Maharashtra from Vasai tahsil of Thane district in 2002. In future it could be a very dangerous pest if not managed well at present and can cause tremendous loss in nut yield. So with the management of this pest, considering the soil fertility, leaching losses, environmental safety and for increasing coconut yield per palm per year this experiment of integrated management was conducted.

### Materials and Methods

The statistically designed field experiment was conducted at Asond block, Central Experimental Station (CES), Wakawali, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli located between 17°14' to 17°45' North latitude and longitude 73° 16' to 73° 19' East with an altitude of 167 to 234 m above mean sea level on the west coast. The average humidity was near about 77.85% and temperature ranges from 18.41 °C to 23.00 °C in randomized block design with ten treatments during 2014-15 and 2015-16. Each treatment was replicated three times. Sixty coconut palms of variety *Pratap* were selected for the experiment purpose.

The treatment details are given below :

T<sub>1</sub> Root feeding with azadirachtin (Neem azal) 5% 7.5 ml + 7.5 ml water and Recommended Dose of Fertilizers (RDF) T<sub>2</sub> Spraying with azadirachtin (Neem azal) 1% @ 4 ml/liter of water + RDF T<sub>3</sub> Drenching with eriophid smash 250 ml/20 liters of water + RDF T<sub>4</sub> Application of RDF through briquettes T<sub>5</sub> Application of RDF and Azadirachtin (Neem azal) through briquettes T<sub>6</sub> Application of RDF, Azadirachtin (Neem azal) and Micronutrients through briquettes T<sub>7</sub> Application of RDF and Neem oil through briquettes T<sub>8</sub> Application of RDF through briquettes + Neem cake 15 kg /palm/year T<sub>9</sub> Recommended dose of fertilizers T<sub>10</sub> Absolute control (No any fertilizer and other)

### Method and timing of application

For treatment T<sub>1</sub> to T<sub>3</sub> and T<sub>9</sub>, recommended dose of RDF (1:0.5:1 Kg NPK/palm/year) i.e. 2.17 kg Urea, 3.13 kg SSP and 1.67 kg MOP/palm/year respectively was given in three splits viz., June, October and February in the palm basin.

#### (a) Preparation of briquettes

Briquettes were prepared at CES, Wakawali, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli by using briquettes preparing electrical machine. For treatments (T<sub>4</sub> to T<sub>8</sub>), required quantity (RDF) was fulfilled by complex fertilizer i.e. Godavari (14:35:14). Urea and Muriate of potash for the preparation of briquettes. In treatment T<sub>4</sub>, RDF dose was prepared with complex fertilizers in briquette form. In treatment (T<sub>5</sub>) with Azadirachtin, the required quantity of Neem azal 5% was added while preparing briquettes. Whereas, for treatment T<sub>6</sub> calculated quantity of micronutrients like Borax, Magnesium sulfate and Molybdenum were mixed with neem azal 5% in the constituents of the briquette. Also for treatment T<sub>7</sub> briquettes were prepared with addition of neem oil (180 ml) instead of neem azal. In treatment T<sub>8</sub>, neem cake (15 kg/palm/year) in pellets form was applied in palm basin for three times in a year with recommended dose of fertilizers through briquettes.

#### (b) Application of briquettes

The briquettes were applied in the palm basin thrice a year i.e. June, October and February (1.5 kg for each application) and covered with the soil. Irrigation was given during summer and winter season through drip as well as flood irrigation as per the requirement.

#### (c) Root feeding

Root feeding of Neem azal 5% i.e. 7.5 ml Neem azal (50000 ppm commercial product) plus 7.5 ml water was given thrice a year viz., November, February and May. The live and active roots were traced by digging the pit near coconut trunk in a basin at a distance of one meter from tree trunk. The root selected was semi-hard, pencil thick and reddish brown colored. Such root was given slanting cut (45 degree) with the help

of sharp knife. The cut was given in one stroke so that it should not blurt. The mixed solution of Azadirachtin 5% @ 7.5 ml + 7.5 ml water was taken in polythene bag of 15 × 10 cm size. Then the bag was tied to root with help of cotton thread. The root was covered with dry grass and soil. It was allowed for absorption by root and observed for 24 h.

(d) *Drenching of eriophyid smash*

The eriophyid smash was drenched in palm basin thrice a year i.e. November, February and May. Eriophyid smash of quantity 250 ml was dissolved in 20 liters of water, stirred well by using thick wooden stick and poured in to a palm basin uniformly around the tree trunk along with the recommended dose of fertilizer.

(e) *Spraying*

The spraying of Neem azal 1% was done in November, February and May. The spraying solution was prepared by adding 4 ml Neem azal (10000 ppm commercial product)/liter of water.

Observation recorded : The observations were recorded at three months interval on third bunch. The per cent infestation was worked out by following formula.

$$\% \text{ Infested nuts} = \frac{\text{Infested nuts}}{\text{Total no. of nuts}} \times 100$$

Data thus obtained was converted in arc sine transformation and analyzed statistically.

## Results and Discussion

The data on effect of different treatments on coconut yield are presented in Table 1. The data on coconut yield during year 2014-15 revealed that, the maximum average nut yield (125.33 nuts) was recorded in treatment application of recommended dose of fertilizers (RDF), azadirachtin (Neem azal) and micronutrients through briquettes (T<sub>6</sub>), which was at par with spraying with azadirachtin (Neem azal) 1% @ 4 ml/liter of

**Table 1.** Effect of different treatments on coconut yield.

Sl. No.	Treatments	Average no. of nuts/palm/year		
		2014-15	2015-16	Pooled mean
1	T <sub>1</sub>	116.50	121.67	119.08
2	T <sub>2</sub>	121.17	122.50	121.83
3	T <sub>3</sub>	119.67	116.00	117.83
4	T <sub>4</sub>	102.17	111.33	106.75
5	T <sub>5</sub>	112.50	117.67	115.08
6	T <sub>6</sub>	125.33	129.50	127.42
7	T <sub>7</sub>	103.33	113.00	108.17
8	T <sub>8</sub>	116.50	116.67	116.58
9	T <sub>9</sub>	93.33	102.50	97.92
10	T <sub>10</sub>	85.33	84.67	85.00
	SE ±	4.29	4.04	4.08
	CD at 5%	12.76	12.01	11.38

water + recommended dose of fertilizers (T<sub>2</sub>), drenching with eriophyid smash 250 ml/20 liter of water + recommended dose of fertilizers (T<sub>3</sub>), root feeding with azadirachtin (Neem azal) 5% @ 7.5 ml + 7.5 ml water and recommended dose of fertilizers (T<sub>1</sub>), application of recommended dose of fertilizers through briquettes + Neem cake 15 kg/palm/year (T<sub>8</sub>), which showed 121.17, 119.67, 116.50 and 116.50 nuts, respectively. The minimum nut yield (85.33 nuts) was found in T<sub>10</sub> (untreated control) which was at par with treatment only recommended dose of fertilizers (T<sub>9</sub>) which showed 93.33 nuts.

During year 2015-16 the highest coconut yield was also noticed in treatment application of recommended dose of fertilizers (RDF), azadirachtin (Neem azal) and micronutrients through briquettes (T<sub>6</sub>) i.e., 129.50 nuts, which was at par with spraying with azadirachtin (Neem azal) 1% @ 4 ml/liter of water + recommended dose of fertilizers (T<sub>2</sub>) (122.50 nuts), root feeding with azadirachtin (Neem azal) 5% @ 7.5 ml + 7.5 ml water and recommended dose of fertilizers (T<sub>1</sub>) (121.67 nuts) and application of recommended dose of fertilizers and azadirachtin (Neem azal) through briquettes (T<sub>3</sub>) (117.67 nuts). The lowest yield was recorded in untreated control (T<sub>10</sub>) i.e. 84.67 nuts

The pooled mean of coconut yield revealed that, the maximum of 127.42 nuts were recorded in the treatment application of recommended dose of fertilizers (RDF), azadirachtin (Neem azal) and micronutrients through briquettes (T<sub>6</sub>) which was found significantly

**Table 2.** Pooled mean of 2014-2016 showing effect of different treatments on infestation of eriophyid mite. \*Figures in parentheses are arc sine transformed values.

Sl. No.	Treat- ment	Pooled mean of infestation			
		May	August	November	February
1	T <sub>1</sub>	45.77 (42.34)	27.71 (30.58)	25.84 (29.65)	14.78 (21.79)
2	T <sub>2</sub>	48.79 (44.08)	27.75 (30.53)	21.40 (27.01)	14.03 (21.26)
3	T <sub>3</sub>	51.56 (46.56)	28.53 (31.33)	35.01 (35.91)	18.45 (24.80)
4	T <sub>4</sub>	50.03 (45.09)	37.73 (37.72)	43.20 (40.96)	27.41 (31.11)
5	T <sub>5</sub>	52.06 (45.94)	30.85 (32.74)	32.44 (34.04)	19.24 (24.93)
6	T <sub>6</sub>	38.88 (38.18)	28.38 (31.21)	20.21 (25.72)	15.63 (22.04)
7	T <sub>7</sub>	54.42 (47.34)	32.87 (34.23)	32.07 (33.87)	25.54 (29.82)
8	T <sub>8</sub>	50.58 (45.35)	32.19 (33.80)	30.60 (32.97)	19.84 (25.85)
9	T <sub>9</sub>	63.49 (53.23)	59.84 (50.73)	48.86 (44.36)	35.65 (36.18)
10	T <sub>10</sub>	74.01 (59.87)	69.66 (56.86)	69.90 (58.99)	51.44 (45.88)
	SE ±	4.81	2.98	4.59	3.54
	CD at 5%	11.67	8.85	13.65	10.54

superior over rest of the treatments except the treatments spraying with azadirachtin (Neem azal) 1% @ 4 ml/liter of water + recommended dose of fertilizers (T<sub>2</sub>), root feeding with azadirachtin (Neem azal) 5% @ 7.5 ml + 7.5 ml water and recommended dose of fertilizers (T<sub>1</sub>), drenching with eriophyid smash 250 ml/20 liter of water + recommended dose of fertilizers (T<sub>3</sub>) and application of recommended dose of fertilizers through briquettes + Neem cake 15 kg/palm/year (T<sub>8</sub>) which recorded 121.83, 119.08, 117.83 and 116.58 nuts per palm per year which were at par with each other. The minimum pooled yield was recorded in untreated control (T<sub>10</sub>) 85.00 nuts.

The results are corroborative with the findings of Shrivastva and Ethel Nguillie [2]. They reported that the recommended dose of fertilizer 600 g N, 1200 g P and 1500 g K/palm/year recorded highest yield.

For management practices different treatment

evaluated and results revealed that, the pooled mean of years 2014-2016 May revealed that, recommended dose of fertilizers (RDF), azadirachtin (Neem azal) and micronutrients through briquettes (T<sub>6</sub>) was found significantly superior over rest of the treatments by showing 38.88% eriophyid mite infestation and was at par with T<sub>1</sub>, T<sub>2</sub>, T<sub>4</sub>, T<sub>3</sub>, T<sub>8</sub>, T<sub>7</sub> and T<sub>5</sub> which showed 45.77, 48.79, 50.03, 52.06, 50.58, 54.42 and 51.56% eriophyid mite infestation, respectively. The results of pooled mean on per cent eriophyid mite infestation of August revealed that, the treatment root feeding with azadirachtin (Neem azal) 5% @ 7.5 ml + 7.5 ml water and recommended dose of fertilizers (T<sub>1</sub>) was significant by showing 27.71% eriophyid mite infestation and was at par with T<sub>2</sub>, T<sub>6</sub>, T<sub>3</sub>, T<sub>5</sub>, T<sub>8</sub>, T<sub>7</sub> and T<sub>4</sub> which showed 27.75, 28.38, 28.53, 30.85, 32.19, 32.87 and 37.73% eriophyid mite infestation, respectively. The data on pooled mean of per cent eriophyid mite infestation of November indicated that, the treatment recommended dose of fertilizers (RDF), azadirachtin (Neem azal) and micronutrients through briquettes (T<sub>6</sub>) was found significantly superior showing 20.21% eriophyid mite infestation and it was at par with T<sub>2</sub>, T<sub>1</sub>, T<sub>5</sub>, T<sub>8</sub>, T<sub>7</sub>, T<sub>5</sub> and T<sub>3</sub> which showed 20.21, 21.40, 25.84, 30.60, 32.07, 32.44 and 35.01% eriophyid mite infestation, respectively. While the pooled mean results of eriophyid mite infestation in February revealed that, the treatment spraying with azadirachtin (Neem azal) 1% @ 4 ml/liter of water + recommended dose of fertilizers (T<sub>2</sub>) was found significantly superior which recorded 14.03% eriophyid mite infestation and was at par with T<sub>6</sub>, T<sub>1</sub>, T<sub>5</sub>, T<sub>3</sub>, T<sub>8</sub>, T<sub>7</sub> and T<sub>8</sub> which recorded 14.78, 15.63, 18.45, 19.24, 19.84, 25.54 and 27.41% eriophyid mite infestation, respectively. The treatment recommended dose of fertilizers (RDF), azadirachtin (Neem azal) and micronutrients through briquettes (T<sub>6</sub>) showed significant role during both the years as well as in pooled results also for per cent reduction of mite population, it may be due to the use of micronutrients and Azadirachtin (Neem azal). Among the micronutrients boron is quite essential for higher plants because boron deficiency causes cracking of nutes. Cracking is associated with mite feeding of coconut meristem. Boron deficiency produces more quinons, which lead to cell damage, cessation of growth and browning of tissues. Boron activates certain dehydrogenase enzymes, facilitate sugar translocation and synthesis of nucleic acid and

plant hormones which are essential for cell division and development of meristematic tissues, flowering and fruit setting. Therefore plant got developed physiological resistance against the mite infestation.

The results of the present findings are in similar with the results of the earlier workers. The different nutrients applied to soil recommended dose of fertilizer (RDF) + full dose of borax +  $MgSO_4$  + gypsum + neem cake, RDF + half dose of borax +  $MgSO_4$  + gypsum + neem cake and RDF + borax were the most effective and significantly superior treatments by Lokesh and Nandihalli [3]. Marimathu [4] reported that among the ecofriendly agents, neem oil, neem oil + garlic extract + Azadirachtin 1% were effective in reducing mite population. The application of 50 kg of FYM, 5 kg neem cake, 1 kg gypsum, 1.3 kg urea, 2 kg SSP and 3.5 kg potash is essential by Vasantha Kumar [5]. Among nutrient management urea 1.3 kg, SSP 2kg and MOP 3.5 kg, gypsum 1 kg, borax 50g, magnesium

sulfate 0.5 kg and growing sun hemp twice in a year (seed rate 30 kg/ha) are recommended.

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