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Evaluation of population dynamics and nutrients on infestation of coconut mite, *Aceria guerreronis* Keifer

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ABSTRACT

The coconut eriophyid mite was reported to cause damage in coconut in the southern region of Bangladesh. Study on the population dynamics of coconut mite, Aceria guerreronis K. was conducted to record their seasonal fluctuation. The mite population on the nut surface ranged were 47.94 to 94.67 mites/25 mm². The highest mite population (94.67/25mm²) was observed in the second fortnight of May. The mite population on perianth fluctuated from the lowest of 18.11 mites (second fortnight of July) to the highest of 44.33 (second fortnight of May). The average damaged percentage of nuts were 86.76 (range 80.40 to 94.69%) throughout the year. Among the different nutrients applied to the soil as urea 1.3kg + TSP 0.7kg + MP 2kg) + MOP (1.5kg) + MgSO4 (50g) +borax (50g) + gypsum (1.0kg) were significantly superior in reducing the mite population (16.89, 73.34% reduction) with the highest reduction percentage of infestation over untreated control (86.62%). Also treatment provided more healthy nuts (53.17 nuts/4 bunches), the least percentage of infested coconut (11.63%) and the highest benefit cost ratio was recorded (2:28) as compared to other treatments.

Key words: incidence, nutrient, infestation, coconut mite

INTRODUCTION

The coconut palm, *Cocos nucifera* L. (Arecaceae) is a plant native to Southeast Asia and the islands between the Indian and Pacific Oceans. It is an important plantation crop grown in more than 93 countries including Bangladesh. The economy of Bangladesh is primarily dependent on agriculture. With about 84 percent of the total population living in rural areas and directly or indirectly engaged in a wide range of agricultural activities, the agricultural sector plays a critical role in the national economy, accounting for 18.7 percent of total gross domestic products in 2012-13 (BBS, 2013). Coconut occupies only 0.65% of total cultivated lands for fruit crops in Bangladesh (Anon 2019) and considered as a crop of high economic value due to diversified uses. The crop is commonly grown in homesteads livelihood with efficient utilization of land and provides regular incomes (Eyzaguirre and Batugal, 1999). The southern part of the country contributes about 80% of total production (BBS, 2011). It has also been estimated that around 44% of total production of coconut is consumed as tender nut and 40% as mature nut for fresh consumption. Only 9% is processed in industries while 7% is used for seedling purpose (Islam, 2002). There is a huge scope of coconut production in the coastal region as the soil and climate is favorable. But the production of coconut is not satisfactory in the region due to infestation of coconut mite (Islam, 2002). Among them, coconut eriophyid mite *Aceria guerreronis* (Keifer) considered to be one of the destructive pest may cause yield loss up to 80% due to induced fruit drop and/ or reduction of fruit size and quality (Moore *et al.* 1989, Haq *et al*. 2002). Occurrence of this mite was first noticed in Bangladesh

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during 2004 (Islam *et al*., 2008). But it is also distributed in Nepal, Maldives and other South East Asian countries. Infestation of coconut mite is noticed all over Bangladesh but severity was recorded from the southern part especially in the coastal districts (Islam *et al*., 2008).

Presently, a large number of chemical pesticides are being tested against the coconut eriophyid mite. Most of these chemicals are not eco-friendly, there is a chance of development of resistance and many are having a residual effect (Chandrasherkar *et al.* 2020). Hence, there is an argent need to search for safer and eco-friendly control the mite. There is a practical difficulty in insecticidal spray to reach the height of coconut trees. Since it is difficult to spray the chemicals in taller coconut palms, root feeding is considered to be a better alternative (Bagde and Pashte 2014; Ramaraju 2000). In Bangladesh the information on seasonal incidence as well performance of root feeding nutritional products and the application methods are scanty against this destructive pest. Keeping the view in considering the potentiality to cause extensive damage of this eriophyid mite, the present study was carried out with mixtures and fertilizers as eco-friendly approaches against this notorious pest.

MATERIALS AND METHODS

The study relating to population dynamics and nutritional management of coconut mite *Aceria guerreronis* (Keifer) (Acari: Eriophyidae) were conducted at the field conditions in three coconut gardens around Regional Agricultural Research Station of Bangladesh Agricultural Research Institute, Barisal during 2016-17 to 2017-18. The coconut gardens consisted of BARI Narical-2 variety of 15-20 years old with 8-10 m in heights planted with a spacing of 7 X 7m. To achieve the objectives, the incidence of coconut mite was observed and evaluated the nutritional practice against mite infested coconut plants. The experimental site was located at 22°70' to 22º75' North Latitude and 90º36' to 90º37' East Longitude with clay loam to sandy loam soil. The experiment was design randomized complete block with three replications. The benefit cost was calculated on the basis of prevailing market prices of coconut, pesticides spraying and management/production cost etc.

$$\text{Benefit Cost Ratio (BCR} = \frac{Net\ Return\ \left(\frac{TK}{Plant}\right)}{\text{Cost of}\frac{\text{Management}}{\text{Production}}\left(\frac{\text{Tk}}{\text{Plant}}\right)} \text{ - - - - - - - - - - - - - - - (1)}$$

Data recoded on different parameters were processed for statistical analysis. Mean comparison for treatments were compared using Duncan's Multiple Range Test (DMRT) at 5% level of significance according to statistical analysis of Panse and Sukhatme (1985).

Incidence and severity of fruit damage caused by *A. guerreronis* K. were assessed on three randomly selected plants per plantation by classifying all coconut fruits on each plant on the basis of the extent of characteristic *A. guerreronis* K. damage visible on fruit surfaces. Binocular was used in case of non-reachable trees by a ladder. Coconut fruits were grouped into three grades based on the percentage of fruit surface damaged by *A. guerreronis* (Moore *et al.* 1989): grade I (1 to 25%), grade II (26 to 50%), grade III (51 to Above). Amongst the harvested coconuts, the infested coconuts were also graded on the basis of visual scoring method given by Murlidharan *et al*., (2001).

The population incidence of mite was counted on the basis of the number of mite presence and infested coconuts after first and second fortnight of every month in year. Three coconut plants were selected from each garden for sampling and were free from pesticides. Three infested coconuts of four months old were plucked from selected plants in each garden. Sampled coconuts were examined with a 10X magnification hand lens immediately after removal from the plant. Each nut was then labelled, placed in a paper bag and brought to the laboratory for observation and recording the active mite population and egg stages. In the laboratory, first the perianths of each coconut were sequentially and carefully removed under 3rd and 4th tepal and observations were made on three spots on surface of the nut covered by the perianth. Then, observed under stereo binocular microscope (Olympus SC 180) and mean population was assessed in an area of 25 mm².

In each garden, five matured bunches from selected three plants were observed to record the mite infested coconuts. Percentage of infested coconuts was calculated by using the following formula.

$$\text{Percent coconuts infestation} = \frac{No\ of\ infested\ coconuts\ X\ 100}{Total\ no\ of\ coconut\ observed} - - - - - - - - - - - (2)$$

Then the population fluctuations of active stages of mite and egg stages were correlated with weather parameters. Weather data of the experimental region were also recorded from concerned weather stations.

Effect of nutrients on infestation of coconut mite

Experiment was conducted to find out the effect of soil application of different macro and micro nutrients, organic manures and neem products on mite infestation. For this research, twenty four plants were selected and considered eight for each replication. There were eight different soil applications of nutrients used for the experiment as treatments along with their dosages mentioned as follows:

Treatment details of soil nutrients application

T_1 = Soil application of MoP + Urea+TSP @ 3.5kg + 1.3kg+0.67kg
T_2 = Soil application of Vermi Compost+MoP+ Urea+TSP @ 20kg + 2.0 kg +1.3kg+0.67kg
T_3 = Soil application of Neem oil cake+ MoP+ Urea+TSP @ 5.0 kg + 2.0 kg +1.3kg+0.67kg
T_4 = Soil application of MgSO4+ MoP+ Urea+TSP @ 50g + 2.0 kg +1.3kg+0.67kg
T_5 = Soil application of Gypsum + MoP+ Urea+TSP @ 1.0kg + 2.0 kg +1.3kg+0.67kg
T_6 = Soil application of Borax + Gypsum + MoP+ Urea+TSP @ 50g + 1.0kg + 2.0 kg +1.3kg+0.67kg
T_7 = Soil application of MoP + MgSO4 + Borax +Gypsum + Urea + TSP @ 3.5kg + 50g + 50g + 1kg + 1.3kg + 0.67kg
T_8 = Untreated control plot

Application of soil nutrients

The predetermined quantity of soil application of nutrients were mixed in the known quantity of recommended dosages of fertilizer and applied by root feeding. Soil nutrients were applied by trained person. The live roots were searched by digging the furrow near the coconut plant or trunk two to three feet apart for each treatment. The soil applications of nutrients were dumped in furrow of 25×30 cm size. Then the roots were dipped in the nutrients mixture. The roots were placed in such a way to have access of total quantity of soil nutrients to be absorbed. Then the furrow was filled to roots with help of spade. It was observed for the application of soil nutrients through roots were imposed in two splits per year at six months interval. The nutrients were applied in first year as 1st dose in September, 2016 with half of the dosage and 2nd dose in March 2017with remaining half dose. Similarly, in second year 1st dose was applied in September, 2017 while 2nd in March, 2018

Observation of coconut mite

The effect of soil nutrients were judged on the basis of the number of mites present in 25 mm² area under perianth and counted infested coconuts before and after application of nutrients. For three infested coconuts, approximately 4th or middle of bunch were selected from spathe. The selected coconuts were removed from the bunch and brought to the laboratory to observe the mite population. From each nut, three inner surface of the inner perianths under tepal and three sliced nut surface areas below the perianth were selected for observations. The perianth of nuts was removed properly without disturbing the surface of coconut below the perianth. Then patch of surface from perianth circumference were removed with help of sharp knife. This cut patch was taken on the stereo binocular microscope to count the number of eggs (Pushpa, 2006). Mites were pre-counted at three, six and nine months after application of soil nutrients as root feeding using stereo binocular microscope. Ten months after the first application of nutrients, the matured

coconuts were harvested, and number of infested, healthy coconuts per plants was observed. The coconuts of 5th to 8th bunches were graded into different categories based on the damage levels and worked out percentage of infested coconuts. The benefit cost ratio (BCR) for different treatments were calculated and analyzed.

RESULTS AND DISCUSSION

Incidence of coconut mite

The pooled mean of two years average coconut mite population data were presented in Table 1. The population dynamics of the mite population on the nut surface were ranged from 47.94 to 94.67 per 25 mm² area. The mite population during the period from first fortnight of August to first fortnight of September fluctuated were ranged from 48.06 to 48.95. These data were gradually increased from second fortnight of September (51.00) to second fortnight of December (64.33) while a sudden increase in up to second fortnight of February (76.50). But the mite population was decreased in first fortnight of March (73.33). Again, then onwards, the population started increasing from second fortnight of March (74.94) and reached peak during second fortnight of May (94.12) and then the population declined sudden from first fortnight of June (72.28) up to the second fortnight of July (47.94). The mite population on perianth was the lowest in second fortnight of July to second fortnight of May. Thereafter, it was suddenly decreased in first fortnight of June. The damage percentage of nuts were relatively higher throughout the year with little variation (79.90 to 94.12%) (Fig.1).

Table 1. Population dynamics of coconut mite during 2016-17 to 2017-18

Month/Fortnight	No. of active mites/25 mm² area of		
	Nut surface	Perianth	% infestation
August-I	48.06	23.28	84.99
August-II	50.45	23.94	83.82
September-I	48.95	23.06	82.62
September-II	51.00	24.06	82.05
October-I	54.00	24.89	82.48
October-II	54.45	26.34	80.53
November-I	56.95	34.61	79.90
November-II	58.44	34.11	80.40
December-I	62.83	34.22	82.37
December-II	64.33	34.28	84.39
January-I	69.34	34.50	87.82
January-II	71.72	36.56	90.25
February-I	76.17	36.44	90.66
February-II	76.50	35.00	90.36
March-I	73.33	34.17	91.61
March-II	74.94	35.00	91.81
April-I	80.17	37.56	89.19
April-II	76.06	38.39	89.24
May-I	88.22	40.22	93.72
May-II	94.67	44.33	94.12
June-I	72.28	23.17	87.52
June-II	63.39	21.00	84.21
July-I	51.22	18.50	82.72
July-II	47.94	18.11	82.23
Average	65.23	30.66	86.21

The present results of population dynamics of coconut mite in the first and second year are closely agreement with Pushpa and Nandihalli (2009) that the surveillance of mite population were 50.01 to 105.73 mites/28.28 mm² area on the nut surface. The mite population during the period

from second fortnight of July to first fortnight of November were 50.20 to 58.89/28.28 mm² area. A sudden increase in mite population was seen in second fortnight of December (68.92). Then onwards it increased up to second fortnight of January (84.26). The mite population was decreased during second fortnight of February (72.29). Then onwards, the mite population was started increasing and reached another peak during second fortnight of May (105.73). Thereafter, the population of the mite was decreased. The mite population was fluctuated from the lowest (18.28 mites) in second fortnight of June to the highest (58.52) in second fortnight of May on perianth. The rest of the months, mite population on perianth was more or less constant. On an average the mite population on nut surface was more (69.80 mites) as compared to perianth (30.41).

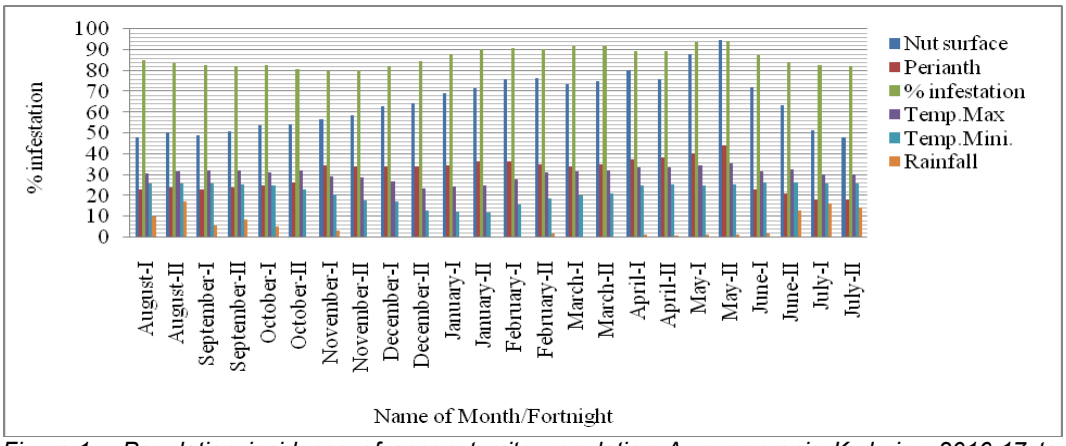

Figure 1. Population incidence of coconut mite population A. guerreronis K during 2016-17 to 2017-18

Population dynamics of coconut mite

The pooled mean of two years average coconut mite population data were presented in Table 1. The mite population on the nut surface were ranged from 47.94 to 94.67. The highest infestation was observed in second fortnight of May (94.12); while the lowest in November (79.90). The mite population on perianth was fluctuated from the lowest of 18.11 (second fortnight of July) to the highest of 44.22 (second fortnight of May).

Effect of soil application of nutrients on the population density of *A. guerreronis*

Application of soil nutrients significantly affected on the population density of *A. guerreronis* (Table 2). But mite population was found non-significant one day before application of soil nutrients indicate that the infestation was uniform which ranged from 43.05-46.34. Among the treatments, the lowest average (22.69) mite population was observed from the application of soil nutrients with a mixture of MOP + MgSO4 + borax + gypsum + RDF at 1.5 kg +50g + 50g +1kg + RDF treatments; while the highest (36.24) in gypsum RDF at 1.0kg + RDF. On the contrary, the highest (57.13) mite population contend from the untreated control. The pooled mean mite incidence at 9 months after soil nutrients application with a mixture of MOP + MgSO4 + borax + gypsum + RDF was provided the highest reduction of mite (60.29%) over untreated control which was significantly superior over other treatments.

In the present findings superiority of the potassium and mixture of nutrients might be due to the fact that potassium imparts resistance to the palm against insect and non-insect pest (Mandal, 1991; Moore *et al*., 1991) and acts as an activator of numerous enzymes, enhances the metabolic processes to reduce the mite incidence (Senthil *et al*., 2000). Sulphur possesses acaricidal property, which probably helped in reducing the mite population. Neem cake contains 2 percent of terpenoids mainly azadirachtin which is responsible for the antifeedant, antiovipositional, growth disruption, fecundity and fitness reducing properties on insects. Pest suppressing activity of neem cake may be attributed primarily to certain phenolic compounds released during decomposition

(Alam *et al.,* 1979) apart from stimulatory effect on root growth which helped profuse growth of roots and absorbed nutrients easily. The present results influenced the source of plant nutrition provided by different soil amendments and this is corroborated by Surekha and Arjuna Rao (2001).

Table 2. Effect of soil nutrients application on the population density of *A. guerreronis* during 2016-17 to 2017- 18

Treatments	Dosage(kg or g) /palm/year in 2 split doses	Number of coconut mites / 25 mm² area								
		1DBS A	3MAFS A	%reduct ion over UTC	6MASS A	%redu ction over UTC	9MAT SA	%redu ction over UTC	Avera ge mites	%reduct ion over UTC
MOP+RDF	1.5 kg +RDF	44.84a	32.61e	34.48b	25.78e	54.93b	19.95e	68.64b	26.12	54.29
VC+RDF	20kg+RDF	43.05a	36.39cd	27.37cd	31.11d	45.87d	26.83c	57.89d	31.44	44.96
Neem oil cake+ RDF	5.0 kg+ RDF	44.61a	34.22de	31.33bc	28.00e	51.14c	23.17d	63.67c	28.46	50.18
MgSO4+RDF	50gm+RDF	45.23a	39.28bc	21.34ef	35.28bc	38.30f	32.11b	49.45e	35.56	37.76
Gypsum+ RDF	1.0kg+RDF	44.50a	40.22bc	19.21f	36.78b	35.33f	32.28b	49.09e	36.43	36.24
Borax+Gypsu m + RDF	50g+1kg+R DF	45.17a	37.61bc	24.80de	33.11cd	42.21e	28.67c	54.92d	33.13	42.01
MOP+MgSO4 +Borax+ Gypsum+ RDF	1.5kg+50g+5 0g+1kg+RD F	46.34a	29.39f	40.82a	21.78f	61.82a	16.89f	73.34a	22.69	60.29
Untreated control plot	-	43.09a	50.33a	0.00g	57.45a	0.00g	63.61a	0.00f	57.13	00.00
CV%	-	5.55	6.93	11.26	6.93	7.43	8.35	5.92	6.21	5.17
LSD	-	2.89	3.05	4.75	2.73	3.59	2.98	3.62	4.97	4.96

Means followed by same alphabet do not differ significantly by DMRT (P=0.05); DBSA= Day Before Soil Application, MAFSA=Month After First Soil Application, MASS A= Month After Second Soil Application, MATS A= Month After Third Soil Application

Table 3. Effect of soil nutrients application on nut infestation due to *A. guerreronis* 2016-17 to 2017-18

Treatments	Dosage(kg or g) /palm/year in 2 split doses	Number of coconuts/4 bunches/plant					Reducti on of infested nut over UTC	Damage grading
		Total coconuts	Healthy coconut	%Healthy	Infested coconut	%Infested coconut		
MOP+RDF	1.5kg +RDF	57.33ab	50.33ab	87.97a	7.00e	12.03ef	86.16	1.44ef
VC+RDF	20kg+RDF	53.67cd	43.83c	81.99bc	9.67cde	17.67cde	79.71	1.66cde
Neem oil cake+ RDF	5.0 kg+ RDF	59.33abc	52.17b	87.93ab	7.17de	12.08def	86.11	1.52def
MgSO4+RDF	50gm+RDF	51.83d	40.17d	78.36cd	11.67bc	21.64bc	75.11	1.85bc
Gypsum+ RDF	1.0kg+RDF	54.83bcd	42.00cd	75.97d	13.17b	24.03b	72.36	2.05b
Borax+Gypsu m + RDF	50g+1kg+R DF	54.00bcd	43.50c	80.92bcd	10.50bcd	19.08bcd	78.05	1.73cd
MOP+MgSO4 +Borax+ Gypsum+ RDF	1.5kg+50g+5 0g+1kg+RD F	60.17a	53.17a	88.37a	7.00e	11.63f	86.62	1.28f
Untreated control plot	-	51.33d	7.00e	13.06e	44.33a	86.94a	-	3.44a
CV%	-	5.61	6.47	6.69	6.44	9.01	-	11.31
LSD	-	3.60	3.10	5.81	2.69	5.77	-	0.25

Means followed by same alphabet do not differ significantly by DMRT (P=0.05)

Effect of soil nutrients on nut infestation due to *A. guerreronis*

Treatments by applied soil nutrients significantly affect the healthy and infested fruits (Table 3). Among the treatments, the highest (88.37%) healthy fruits were observed from the application of soil nutrients with a mixture of MOP + MgSO4 + borax + gypsum + RDF at 1.5 kg +50g + 50g +1kg + RDF which is statistically similar to Neem oil cake + RDF (87.89%) at 5.0kg + RDF treatments; while the lowest (80.29%) in Borax + Gypsum + RDF at 50g + 1kg + RDF. Conversely, the lowest (13.06%) healthy fruits were observed from the untreated control. Similarly, the lowest (911.63%) infested fruits were found from the application of soil nutrients with a mixture of MOP + MgSO4 + borax + gypsum + RDF at 1.5 kg +50g + 50g +1kg + RDF; while the highest (24.03%) in Gypsum + RDF at 1.0kg + RDF. On the contrary the highest (86.94%) infested fruits were observed from the untreated control. Again the lowest (1.28) damage grading score of fruits were found from the application of soil nutrients with a mixture of MOP + MgSO4 + borax + gypsum + RDF at 1.5 kg +50g + 50g +1kg + RDF while the highest (3.44) in the untreated control (Table 3).

The present findings are in confirmatory with Lokesh and Nandihalli (2009) who reported that the different nutrients applied to soil recommended dose of fertilizer (RDF) + full dose of borax + MgSO4 + gypsum + neem cake, RDF + half dose of borax + MgSO4 + gypsum + neem cake and RDF + borax were the most effective and recorded 42.10, 36.03 and 34.11 percent reduction of mite over control. With respect to per cent damaged nuts and grade indices, RDF + full dose of borax + MgSO4 + gypsum + neem cake, RDF + MgSO4, RDF + half dose of borax + MgSO4 + gypsum + neem cake and RDF + gypsum were the effective treatments and recorded 19.29 to 34.06 percent damaged nuts and 1.56 to 1.83 damage grading. Triangular yellowish brown patches extending distally on the fruit surface from beneath the perianth of young developing button indicated the typical symptoms of mite attack. When the perianths of infected nuts were removed, brown lesions were noticed around the stalk. Treating plants with MOP + MgSO4 + Borax + Gypsum + RDF or Neem oil followed by MOP + RDF, Neem oil cake + RDF, vermicompost + RDF, Gypsum + RDF, Borax + Gypsum + RDF, MgSO4 + RDF, removing of infested nuts, bunches and inflorescences stopped mite attack. As a result, the harvested nuts were spotless with attractive smooth pericarp. Finally as considers over all experimental data its revealed that treatment which comprises root feeding of soil application of nutrients, MOP @ 1.5 kg + MgSO4 @ 50gm + Borax @ 50gm + Gypsum 1.0 kg + RDF found most effective followed by MOP @ 1.5 kg +RDF, Neem oil cake + RDF, Vermicompost + RDF, mixture of Borax + Gypsum + RDF, MgSO4 + RDF in management of eriophyid mite population. This result is agreement with Islam *et al.* (2008) concerning soil fertilizer along with mite infestation.

Table 4. Cost and return analysis of coconut under various treatments due to *A. guerreronis*

Treatments	Dosage(kg or g) /palm/year in 2 split doses	Marketable yield (nuts)		Gross return Tk./plant	Cost of Treatment Tk./plant	Net return Tk./plant	Benefit Cost Ratio
		Healthy	Infested				
MOP+RDF	1.5kg +RDF	50.333	7.000	1070	330.05	739.95	2.24
VC+RDF	20kg+RDF	43.833	9.667	980	407.55	572.45	1.40
Neem oil cake+ RDF	5.0 kg+ RDF	52.167	7.167	1130	357.55	772.45	2.16
MgSO4+RDF	50gm+RDF	40.167	11.667	920	309.55	610.45	1.97
Gypsum+ RDF	1.0kg+RDF	42.000	13.167	938	314.55	623.45	1.98
Borax+Gypsum + RDF	50g+1kg+R DF	43.500	10.500	990	326.05	663.95	2.04
MOP+MgSO4 +Borax+ Gypsum+ RDF	1.5kg+50g+50g+1kg+RD F	53.17	7.00	1150	350.55	799.45	2.28
Untreated control plot	-	7.00	44.33	455	200	255	1.28

Market price of healthy coconut Tk. 20/coconut, Infested (grade < 2), Tk. 10/coconut (grade >2) Tk. 7/nut, Cost of MOP=15 Tk./kg, cost of urea = 16 Tk./kg, cost of TSP = 25Tk./kg, Cost of Boron = 260 Tk./kg, cost of Gypsum = 7 Tk./kg, cost of Magnesium sulphate = 40Tk./kg, Cost of Vermi compost=5 Tk./kg, cost of neem cake = 25 Tk./kg, cost of TSP= 25Tk./kg, Benefit Cost Ratio (BCR)

= Net return (Tk./plant)/ Cost of management (production) (Tk. /plant). Labour cost for nutrients application and counting Tk. 60/time. Plant being required for one treatment of coconut plant applied and counting of coconut in one time was sixty taka/labour/coconut. Other variable costs were same in all the treatment.

Effect on return and benefit cost ratio of nut under various treatments due to *A. guerreronis*

The pooled mean of two years 2016-17 and 2017-18 return and benefit cost ratio are presented in Table 4. The gross return, net return and benefit cost ratio were varied depending on the cost of treatment. Among the different treatments, the highest gross (Tk. 1150) and net return (Tk. 799.45) and benefit cost ratio (2.28) was obtained in mixture content of MOP @ 1.5 kg + MgSO4 + borax + gypsum + RDF followed by MOP @ 1.5 kg + RDF gross return (Tk. 1070), net return (Tk. 739.95) and benefit cost ratio (2.24). Conversely, the lowest gross return (Tk. 455) and net return (255) and benefit cost ratio (1.28), was recorded from the untreated control which was found inferior as compare to the other treatments. These profit findings showed a properly BCR due to cost of treatments.

CONCLUSION

The mite population was more on coconut surface than on perianth which might be due to more succulence surface. Decreased population were observed during rainy and winter season where high relative humidity prevailed as compared to summer season. The results of the present study indicated that among the different nutrients applied to soil recommended dose of fertilizer (urea 1.3kg + TSP 0.7kg + MOP 2kg) + MOP (1.5kg) + MgSO4 (50g) +borax (50g) + gypsum (1.0kg) was found significantly superior in reducing the mite population with the highest reduction of infestation over untreated control which provided more healthy. However, the pest management tools should be safe, cost-effective and have minimum risk or hazard to human and desirable components of environment.

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