วารสารเกษตร 15(1) : 39 - 46 (2542)
Journal of Agriculture 15(1) : 39 - 46 (1999)

Field Evaluation of Pyrimidifen for Controlling of The African Red Mite, *Eutetranychus africanus* (Tucker), on Tangerines in Chiang Mai

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Abstract : The field evaluations of pyrimidifen (Miteclean®) for controlling of the African red mite, *Eutetranychus africanus* (Tucker), on tangerine, *Citrus reticulata* cv. "Sai Nam Pueng", compared with some selected acaricides were conducted at the tangerine orchard of Chiang Mai Thanathon, Co., Ltd., Fang District, Chiang Mai Province. Pyrimidifen at the rates of 10 and 20 ml per 20 liters of water and abamectin at the rate of 20 ml per 20 liters of water were the most efficacious in controlling *E. africanus* and their persistency were 14-21 days while amitraz and propargite both at the rates of 30 ml per 20 liters of water exhibited the second level of efficacy and their persistency were shorten to 7 days.

Index words : pyrimidifen, *Eutetranychus africanus*, tangerine, african red mite

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Introduction

Mandarin orange or tangerine (*Citrus reticulata* Blanco) is a high-value commodity with high nutritional value and considered as one of the high-return economic crops in Thailand. Apparently, tangerine orchard is able to establish quite well in all regions of Thailand. DOAE (1998) revealed a total tangerine-growing areas in 1995 growing season in Thailand was 264,039 rais (42,246.24 ha) providing an average yield of 3,404 kg/rai (21,275 kg/ha) for local consumption and export produced the incomes valued exceed 10 million Baht. Extensive expanding of tangerine cultivated areas at present were obviously developed in the northern region in accordance with the commensurate climatic and soil conditions providing a higher yield of 4,415 kg/ rai (27,593.75 kg/ha). Nevertheless, Thai tangerine, on the average, produced rather poor production both in terms of quantity and quality. This was probably due to the pest complex, especially the citrus mites, being one of the chief limiting factor. Charanasri *et al.* (1988) listed a total of 10 mites species attacked tangerine of which African red mite, *Eutetranychus africanus* (Tucker), is the most destructive one. This mite has been considered as a major pest of the tangerine orchards throughout the country. Both nymphs and adults prefer to extract the sap from the upper surface of the foliages producing tiny gray and silvery spots. As the damage is severe, the leaves become totally silvery due to most of the chlorophyll is deleterious, hence, the normal photosynthetic process of the plant are greatly inhibited (Charanasri, 1992)

In successful management of the citrus mites, the intensive applications of acaricides are needed and the hazardous chemical residue concentrated in the products are harmful to the consumers, besides the excessive residue also contaminate to the citrus ecosystem. Only careful attention with high consideration on acaricide application should lessen the chemical residue problems. However, continuous applications of only single acaricide for a quite extensive period might promote the citrus mite to develop resistance to the acaricide (DOA, 1998; Unahawutti *et al.* 1992). Sirising *et al.* (1992) summarized the build-up resistance of the mite pests to previous recommended acaricides. Recently, Omoto *et al.* (1995) reported the citrus rust mite, *Phyllocoptruta oleivora* (Ashmead) developed resistance to dicofol in Florida citrus orchards. Increasing resistance of the citrus mites to the acaricides had placed heavy pressure on the citrus growers to increase the time and rate of acaricide application and eventually shifted to new acaricide to assure the effectiveness of the mite management. Thus, the management cost for the mite pests has considerably increased.

Pyrimidifen, a new phenoxyethyl amine compound jointly developed by Ube Industries, Ltd. and Sankyo Co., Ltd. in Japan, is available on the foreign market as Miteclean®. This

acaricide is proved experimentally by various countries to exhibit a high level of efficacy against several species of mite pests at all developmental stages (Sankyo, no date).

The primary objectives of these experiments are to determine the efficacy of pyrimidifen and other recommended acaricides against the African red mite (*E. africanus*) under citrus orchard ecosystem in Chiang Mai and future prospect of pyrimidifen as a recent alternative acaricide for better African red mite management to assure the high quantity and quality of the tangerine production and encourage the sustainable tangerine cultivation in Thailand.

Materials and Methods

In 1997-1999, field evaluations of selected acaricides were conducted at tangerine orchard of Chiang Mai Thanathon Co., Ltd., Fang District, Chiang Mai, Thailand. The experiments were arranged in a randomized complete block design with four replications. Each experimental unit consisted of a single tangerine tree (*Citrus reticulata* cv. "Sai Nam Pueng") at the age of 3.5 years old with means of 2.80 m high and 2.00 m canopy width. Every other tree were selected from each row of the experimental plot for a total of 24 trees. The plot was under typical cultural practices with no pesticide application on any of the experimental trees.

Six treatments of selected acaricides were evaluated under citrus orchard ecosystem for their efficacy against the African red mite (*E. africanus*) as follows:

1. pyrimidifen 4 % SC at the rate of 2 g ai/100 liters of water (10 ml/20 liters of water)
2. pyrimidifen 4 % SC at the rate of 4 g ai/100 liters of water (20 ml/20 liters of water)
3. abamectin 1.8 % EC (Vertimec®) at the rate of 20 ml/20 liters of water
4. amitraz 20 % EC (Mitac®) at the rate of 30 ml/20 liters of water
5. propargite 20 % EC (Omite-20®) at the rate of 30 ml/20 liters of water
6. check (untreated)

The experiment was not conducted till the large mite population reach the appropriate level. Monitoring on the mite populations were achieved by randomly selected for a total of 25 citrus leaves per tree (6, 6, 6, and 7 leaves at eye level were taken from north, east, west, and south of the tree, respectively) and only the numbers of female adult mites existed on the upper and lower surfaces of the assigned leaves were recorded.

All treatments were applied with a manual compression sprayer (Matabi, model Merk-7) equipped with single hollow cone nozzle. Each treatment was mixed with Latron CS-7, a spreader and binder, at the rate of 3 ml/20 liters

of water, for better spray distribution with good coverage on the treated tree and the mite body. A total of 2 liters of the spray volume of each treatment was applied as coverage spray on each experimental tree until run-off. Monitoring on the numbers of the female adult mites were scheduled to operate before treatment application and at 1, 7, 14, 28, 35, and 42 days after application. However, no further evaluation was proceeded when the mite populations recorded in all treatments were demonstrated no statistically significant difference. Data on mean numbers of the mite population per leaf by treatments were collected, the analysis of variance and the mean separation were performed by the Duncan's new multiple range test (DMRT) using the M-STAT program.

Results and Discussion

The mean numbers of African red mite (ARM) female adult population per leaf according to acaricide treatment applications is given in Table 1. ARM female adult populations before application did not differ among all treatments, however, the mite populations in all acaricide treatments were drastically decreased after 1 day of application. Tangerine trees treated with pyrimidifen (10 ml), pyrimidifen (20 ml), abamectin, and amitraz yielded the same level of efficacy in reducing the ARM populations, though they demonstrated significantly more efficacious in the mite management than propargite treatment.

Table 1 Efficacy test of some acaricides for controlling *Eutetranychus africanus* (Tucker) on tangerine at Fang, Chiang Mai, during 19 November to 3 December 1997.

Treatment	Dosage (ml/20 l of water)	Mean number of female mite per leaf [1/]			
		BA	1 DAA	7 DAA	14 DAA
pyrimidifen 4 % SC	10	5.51 a	0.36 c	3.99 b	4.16 a
pyrimidifen 4 % SC	20	4.78 a	0.59 c	2.14 b	3.02 a
abamectin 1.8 % EC	20	4.91 a	0.09 c	2.76 b	3.27 a
amitraz 20 % EC	30	4.61 a	0.47 c	2.70 b	4.06 a
propargite 20 % EC	30	5.54 a	2.43 b	3.63 b	3.90 a
untreated	-	5.58 a	4.64 a	7.22 a	4.15 a

[1/] Means within the column followed by the same letter are not significantly different at 5 % level by DMRT.

BA = Before application ; DAA = Day after application

After 7 days of application, the trees treated with pyrimidifen (20 ml) exhibited the lowest mite population of 2.14 female adults per leaf, although there were no statistically significant difference among the mite populations in all treated trees. The mite populations in all treatments were rapidly recovered after 14 days of application and showed no significant difference among treatments. The main reason was probably due to the unexpected occurrence of the rain precipitation within 2 hours after acaricide application. The rain might leach some of the acaricide toxicant away from the leaves and the retained chemical residue was efficacious for only short duration.

Although the tested results from the first trial was incomplete we would conclude that all of the selected acaricides exhibited rapid knockdown effect, and provided rather quick and better management of the mite population, their persistency should extend longer than 7 days after application under no-rain condition.

Following the first trial, we planned to duplicate another experiment with the same arrangement in the succeeding year, nevertheless, the ARM population remained very low throughout the 1998 tangerine season. The second trial could not initiate till April 1999, a new experimental plot was selected for replacement since the over-sized tangerine trees in the original plot were discouraged the treatment assessment.

The second trial outcomes were demonstrated in Table 2. After 1 day of application, all acaricide treatments steadily exhibited significantly less ARM female adult population than the untreated check, corresponding with the first experiment. However, amitraz and propargite treatments displayed no significant difference in reducing the mite population as the untreated check, after 7 days of application. Hence, the efficacy of these two treatments were persisted for only 7 days.

Table 2 Efficacy test of some acaricides for controlling *Eutetranychus africanus* (Tucker) on tangerine at Fang, Chiang Mai, during 20 April to 25 May 1999.

Treatment	Dosage (ml/20 l of water)	Mean number of female mite per leaf [1/]						
		BA	1 DAA	7 DAA	14 DAA	21 DAA	28 DAA	35 DAA
pyrimidifen 4% SC	10	2.09 a	0.16 b	0.77 bc	1.30 bc	1.48 bc	0.65 b	0.21 a
pyrimidifen 4% SC	20	2.80 a	0.03 b	0.50 c	1.28 bc	1.36 c	1.20 a	0.24 a
abamectin 1.8%EC	20	3.16 a	0.05 b	0.86 bc	0.63 c	0.86 c	0.23 c	0.09 a
amitraz 20% EC	30	3.51 a	0.44 b	1.87 abc	2.62 ab	2.14 ab	0.43 bc	0.12 a
propargite 20% EC	30	3.20 a	0.41 b	2.18 ab	2.96 a	2.32 a	0.67 b	0.09 a
untreated -	2.61 a	2.10 a	3.02 a	2.65 ab	2.16 ab	0.72 b	0.14 a	

[1/] Means within the column followed by the same letter are not significantly different at 5% % level by DMRT.
BA = Before application ; DAA = Day after application

Pyrimidifen (at both concentration rates) and abamectin treatments demonstrated significantly less mite populations than other treatments and their effectiveness were extended to 14 days. Due to several moderate and heavy rainfalls occurred after 21 days of the treatment applications, all treatments exhibited extremely low means ARM population per leaf. The mite populations continued to diminish and displayed no significant difference among all treatments after 35 days of application.

Although the second trial provided preferable outcomes, the unexpected rain occurred within 5 hours after acaricide treatment applications had worsen our strong determination. Hence, on the following week, we decided to conduct the third trial in concurrent with the second one by selecting unassigned tangerine trees within the second experimental plot using the same arrangement. Except the abamectin treatment rate was decreasing to 10 ml per 20 liters of water, all other acaricide treatments were applied as original rates.

The third trial outcomes were displayed in Table 3. There was no rain precipitation within 24 hours after acaricide application. The third trial exhibited consistent research outcomes and corresponded with the second trial. After 14 days of application, pyrimidifen (at the rates of 10 and 20 ml per 20 liters of water) and abamectin treatments were significantly more efficacious in management of ARM adult population and showed longer persistency than amitraz and propargite treatments. The mean numbers of female mite per leaf collected at 21 and 28 days after application were also subjected to continued rain precipitation. The mite population constantly decreased and exhibited no significant difference among all treatments after 28 days of application. Research consequences from the second and third trials both indicated that the occurrence of the rain precipitation after 5 hours of application displayed no effect on any treatment efficacy.

Table 3 Efficacy test of some acaricides for controlling *Eutetranychus africanus* (Tucker) on tangerine at Fang, Chiang Mai, during 27 April to 25 May 1999.

Treatment	Dosage (ml/20 l of water)	Mean number of female mite per leaf [1/]					
		BA	1 DAA	7 DAA	14 DAA	21 DAA	28 DAA
pyrimidifen 4% SC	10	3.21 a	0.26 b	0.89 b	0.94 b	0.76 bc	0.29 a
pyrimidifen 4% SC	20	2.94 a	0.05 b	0.71 b	0.76 b	0.92 ab	0.31 a
abamectin 1.8% EC	10	3.03 a	0.04 b	0.61 b	1.05 b	0.38 c	0.17 a
amitraz 20% EC	30	3.77 a	0.46 b	1.40 ab	1.99 a	0.96 ab	0.23 a
propargite 20% EC	30	3.12 a	0.23 b	0.87 b	2.40 a	0.81 abc	0.36 a
untreated	-	3.80 a	2.42 a	2.09 a	2.13 a	1.25 a	0.17 a

[1/] Means within the column followed by the same letter are not significantly different at 5 % level by DMRT.
BA = Before application ; DAA = Day after application

Conclusion

All acaricide treatments demonstrated more efficacious in controlling the African red mite, *Eutetranychus africanus* (Tucker). However, pyrimidifen (at the rates of 10 and 20 ml per 20 liters of water), and abamectin were the most efficacious in management of the mite population. Their persistency were 14-21 days while amitraz and propargite exhibited second level of efficacy and their persistency were shorten to 7 days.

Pyrimidifen is a new acaricide and highly effective against the African red mite at all developmental stages. It is rather harmless acaricide with acute oral LD_{50} for rats is more than 5,000 mg/kg, and practically nontoxic to mammals, the half-life in soil is 5-9 days under field conditions. The future prospect of this acaricide in Thailand should be brilliant if its unit cost is competitive. Thai tangerine-growers may satisfy with this alternative and desirable acaricide for better African red mite management to assure the high quantity and quality of the sustainable tangerine production in Thailand.

Acknowledgements

The research team would like to express their thanks and sincere appreciation to Mr. Banthoon Jirawattanakoon, Chairman of Chiang Mai Thanathon, Co., Ltd., for providing parts of the company tangerine orchard area for our field trials and make possible the accomplishment of this investigation. Special thanks are expressed to Miss Sunan Prasitsooksant and Miss Pitsamai Maiprom for their great assistance and good management of the tangerine orchards in the experiment plots during the trials.

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