

# IPM on Citrus with an Emphasis on Citrus Psylla Control in Tan Phu Thanh village

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## Tóm tắt

Mô hình phòng trừ tổng hợp sâu hại (IPM) trên cam mật được tiến hành trên diện tích 6.700 m<sup>2</sup> tại xã Tân Phú Thạnh, huyện Châu Thành, tỉnh Cần Thơ với các biện pháp kỹ thuật canh tác (trồng cây chắn gió, cắt bỏ cây bệnh và trồng lại bằng cây sạch bệnh, tỉa cành tạo tán, vệ sinh vườn...), phòng trừ sinh học với kiến vàng và phòng trừ hóa học với dầu khoáng cùng với việc phòng trừ tổng hợp rầy (côn trùng trung gian truyền bệnh VLG) và quản lý tổng hợp vườn cây có múi. Các kết quả tiến độ cho thấy có thể thiết lập và phát triển kiến vàng trong vườn kết hợp phun dầu khoáng để phòng trừ sâu vẽ bùa, rầy chống cánh có hiệu quả. Ngoài ra, sử dụng phân hữu cơ làm tăng chất lượng quả như tăng độ ngọt và giảm đáng kể các vết sẹo, lem do bệnh ghẻ, loét nhện, bù lạch. Do mô hình mới thực hiện nên chi phí đầu tư cao do có thay cây chết và nhiễm nặng bệnh Vàng lá greening hiệu quả kinh tế chưa có thể tính chính xác được.

## 1. Introduction

Hoang Long Bin (HLB) is of serious diseases, which caused considerable loss for citrus industry in the Southern of Vietnam. The disease spreads out through vegetative propagation and, beside that, citrus psylla (*Diaphorina citri* Kuwayama) play also an important role as the vector for the disease transmission (Aubert, 1984; Aubert 1987; Capoor et al, 1967). The result of pests and diseases investigation in Southern of Vietnam carried out by Huynh *et al.* 1995 and Nguyen et al. 1998 showed that there was high population and wide distribution of psylla in the area. Therefore, to enhance the progress of citrus improvement, citrus psylla must be efficiently controlled.

This IPM practice was established at Long An, Tan Phu Thanh village in a demonstration of 6,700 m<sup>2</sup> with 500 Mat orange trees with the following objectives:

- To control citrus psylla (vector of HLB) by IPM program application emphasis on management of green ants *Oecophylla smaragdina* (Fab.) and horticultural mineral oil (HMO) spraying.
- To develop an IPM along with a training program for citrus growers at Tan Phu Thanh village.

## 2. Methodology

**Location:** Long An, Tan Phu Thanh village, in the 4- years -old orchard, area cover 6.700m<sup>2</sup>, cultivar sweet orange, density 500 trees in total, the high of tree average 2,5 - 3m and canopy about 2,5 diameters.

**Timing:** 2001-2002

**Orchard management:** Main activities could be:

- Pruning after harvesting.
- Organic fertilizer application.
- Minimize chemical fertilizer and pesticide application.
- Good water management.
- Orchard sanitary and fruits.

**Integrated Pest Management (IPM):**

- Monitoring schedule every week on the key pests and diseases of citrus.
- Establishing and maintain the green ant colony to against citrus pests for reducing of pesticides application.
- Selection of pesticides to maintain well green ant colony.

- Recording the presence of psylla by monitoring, trapping by yellow sticky trap and attractant plant (*Murraya paniculata*)
  - Establishing windbreak.
- Observations:
- Every week the key pests and diseases population include citrus psylla, citrus leaf miner, citrus aphids, mealy bug, scale, thrips and citrus canker disease by monitoring 30 trees.
  - The colonizing and developing of green ant colonies.
  - Determine species located on demonstration by vacuum samples.
  - Quality of fruit: (color, mite/thrips blemish, scale infestations, canker infestations).
  - Yield.

### 3. Result and Discussion

#### Integrated Pest Management on demonstration

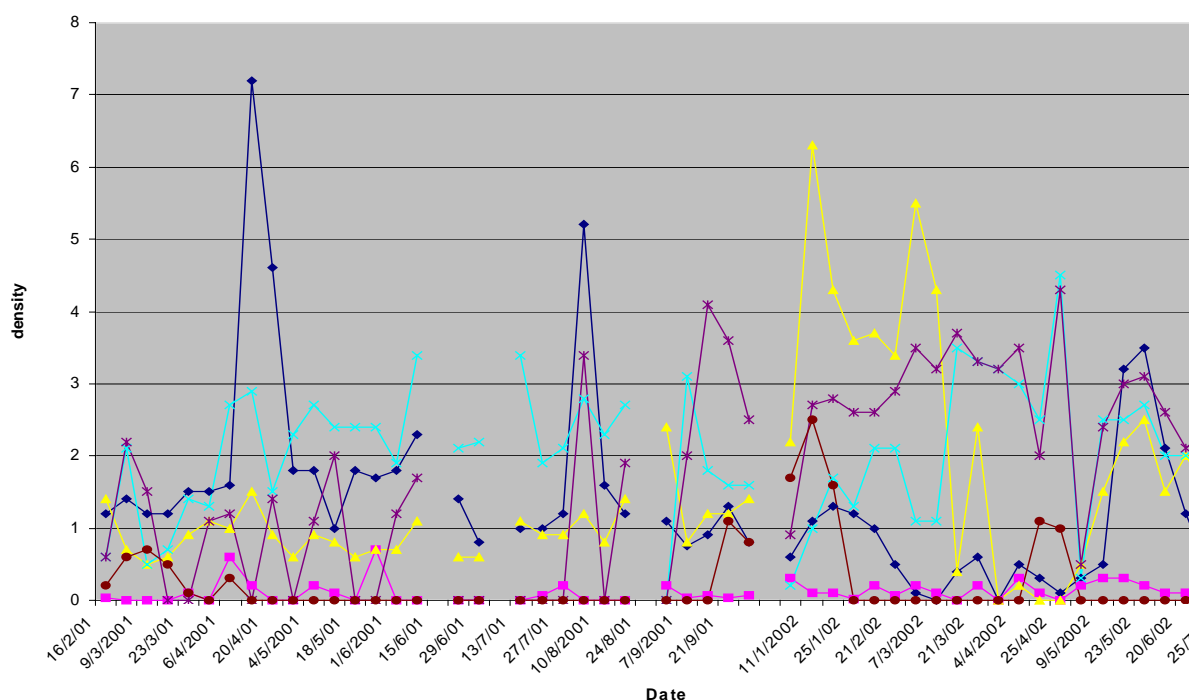


Fig 1: Population of pests on demonstration of Mat orange at Tan Phu Thanh Can Tho (SOFRI, 2002)

Citrus psylla was recorded to be available year around under climate conduction at Mekong Delta (MKDT). So, It is easily to reach high population. In demonstration, the recorded population of psylla was not high as only 0.01 - 0.7 psylla/ shoot (Fig 1). Usually, it presented on some trees at the end of the orchard, this site is nearby a neighbour orchard of king mandarin. In year 2001, the times of psylla appearance was less than year 2002 but the number of psylla (0.7 psylla/ shoot) was higher than year 2002 (0.3 psylla/ shoot).

Citrus leaf miner was similar result as citrus psylla. In 2001, there were two peaks of population: in March and August with percentage damage were 7.2 % and 5.2 %. And year 2002, there was only one peak development of leaf miner with the damage was 3.5 %. It was also less damage than year 2001 (Fig 1).

The decline of these pests could be explained by the good result of green ant usage. It was evident that the green ants could control citrus psylla and citrus leaf miner attacked in the orchard. In year 2001, we had just established the colonies of green ant. At the beginning with small number consisted of 3 nets, and from February to September of 2001, they developed to 37 nets. And this small number of ant nets could not cover the whole orchard but developed in small part of orchard and mainly on mixing plants in the orchard like mango, hot plum and durian.

The ant colonies was then quickly developed from 2001 to 2002, colonies became abundance and they expanded to every where in the orchard. In 2002 total ant nets counted was 481 in number. They live in every plant in the orchard (table 1) consist of mango, durian, hot plum, calophyllum and orange. The

number and size of nets in mixing plants were bigger than in orange. It meant that these plant species were considered as good host for ant colonies to develop as the big size of ant nets with the queen ant existed.

Activities of ants were not only in these trees but they also made the small nets in orange trees with density of net was about 0.4 net/ tree. The nets in orange trees were temporary nets for staying of ant workers. And so, they could feed the insects or eggs of insects and protect the trees well. Of the pests, citrus psylla and citrus leaf miner were mostly controlled as their populations were recorded to be low.

Table 1: Green ant population on Mat orange orchard at Tan Phu Thanh Can Tho (SOFRI, 2002)

Kinds of tree	Total nets	Nets/ tree
Sweet orange	300	0.4
Mango	84	12
Calophyllum	12	4
Durian	45	3
Hot plum	40	4
Total	481	
Net size		25-35 cm
Population		150/ 5 min

*Note: Observation date on August 2002*

Table 2: Biodiversity of species on sweet orange demonstration (SOFRI, 2002)

No	Order	Number of individuals	
		Tien Giang	Can Tho
1	Colembola	163	48
2	Ephamoptera	-	5
3	Blattoidea	1	2
4	Orthoptera	1	5
5	Psocoptera	1	1
6	Homoptera	91	52
7	Heteroptera	19	11
8	Thysanoptera	1	2
9	Neuroptera	-	5
10	Coleoptera	9	59
11	Diptera	287	161
12	Lepidoptera	-	4
13	Ants	71	127
14	Other Hym	73	56
15	Aranedae	65	104
16	Acari	2	8
17	Trichoptera	-	1
18	Gastropoda	-	9
19	Other sp1	-	1
20	Other sp2	-	1
	Total	794	662
		13	20

*Notes: 30 Samples were collected by vacuum in each orchard*

Citrus aphids, mealy bug and scale have got a contrary result. In 2002, they developed higher than in 2001 although density of green ants developed well in the orchard. It showed the relation between green ant with aphids, scale and mealy bug. Wherever aphids, scale and mealy bug existed plenty of green ants was also existed. They feed the honeydew extract from aphids, scale and mealy bug. However, to reduce the population of mealy bug, scale and aphids we had to apply the horticultural mineral oil (HMO).

Citrus canker disease was managed by orchard sanitary. It was usually done by removing all the infested part of the tree as twigs, leaves and fruits with canker damage followed by copper fungicide spraying. The work was done mainly before the rainy season to clean up orchard carefully. This work could reduce the canker developing in the rainy season very well.

Generally, it could be said that the population of key pests in the demonstration orchard in 2002 was lower than that of 2001. Beside the IPM impact the cultural practices were proved to enhance the trees health increasing the tree tolerance to the attack of pests and diseases. The green ant was really a good key element on integrated pest management together with HMO spraying.

### Biodiversity of species on demonstration

We also have determined on the biodiversity of the insect species in demonstration orchard to compare with conventional orchard in Tien Giang province. The result showed that about 20 orders of arthropod were collected on demonstration of Tan Phu Thanh, Can Tho while only 12 orders in other the conventional orchard

### Integrated orchard management

Regarding the works of integrated orchard management were done in demonstration from 2/2001 to 10/2002. It was showed on table 3.

Before carrying out the demonstration we had investigated the Hoanglong bin disease in the orchard. There were 168 trees with the typical and heavy symptom of Huang long bin disease. After the last harvested on mid of June, all the infested trees of HLB were cut down and moved out after the cover spray of insecticide to ensure no more psylla alive in the infested trees. Then the free disease seedlings of Mat variety were provided from SOFRI for replanting in December of 2001. Now they are developing well.

Table 3: Major farming practices done in the orange demonstration Tan Phu Thanh, Cantho (SOFRI, 2002)

No	Activities	Performance	Dated
1	Surveyed to check the HLB infested trees by symptom	168 trees	2/2/001
2	Cutting the infested trees after sprayed insecticides to control citrus psylla (two times after harvested)	168 trees	07/01
3	Replanted free diseases seedling provided by SOFRI	168 trees	12/01
4	Monitoring schedule done weekly on the orchard	-	02/01
5	Set up yellow sticky traps	5 traps	2/2/01
6	Planting <i>Murraya paniculata</i> around the orchard (attractant agent to citrus psylla)	100 plants on 4 sides of the orchard	21/7/01
7	Established green ant colonies	3 nets of green ant were transferred	3/01
8	Developing and maintaining the green ant colonies	481 nets of green ant	9/2002
9	Removing the infested branches and fruit of citrus canker	Frequently	-
10	Pruning trees after the last harvest fruits	-	-
11	Planted water apple for the wind break trees in the remaining side of the orchard	-	6/01
12	Fertilizer		
	- Chemical fertilizer	400 kg/ year	-
	- Organic fertilizer	4.000 kg/ year	-

Note: The works were done from Feb/2001 to 10/2002

The cultural techniques applied to enhance the health of trees were consisted of tree pruning 2 times after harvesting in March and June, applying fertilizers and organic fertilizer (0.8kg/ of NKP, and 8 kg organic fertilizer/ each tree). In addition, orchard sanitary was periodically done by removing all the infested part of the tree, citrus canker damaged twigs, leaves and fruits were included.

Table 4: Performance of fruit quality on IPM demonstration and other orchard (SOFRI, 2002)

Items	Demonstration	Conventional farmer
Blemish of fruit	3.58 ns	3.35 ns
Weight (g)	165.23 ns	155.93 ns
Brix	9.21*	8.72*
Scab (%)	6.7	3.3
Canker (%)	10	13.3
Mite (%)	0	23.3
Thrips (%)	53.3	40

*Note: 30 fruits each orchards were randomly collected in every harvests  
Conventional farmer at Tan Phu Thanh. Can tho;  
Blemish of fruit following scale 1-5*

Quality of fruits on demonstration was analyzed and compared with a conventional orchard 4 year olds located nearby the demonstration. Result showed that the blemish and the weight of fruit were not significant different by t test between the demonstration with conventional orchard (Blemish:  $t = 1.2754$ ,  $P = 0.1036$ ; weight of fruit:  $t = 0.8427$ ,  $P = 0.2014$ ). However, sugar contain of fruits in demonstration orchard was significantly higher than that of the conventional orchard with t test ( $t = 1.65$ ,  $P < 0.05$ ). This result was similar to the conclusion of Nguyen (1999) as a result of organic fertilizer application. It was recorded that the diseases in demonstration orchard was lower incidences than that of the conventional orchard. Other pests such as thrips and mite damage could not be seen on fruits harvested from the demonstration orchard.

Table 5: Economical efficacy on demonstration of sweet orange at Tan Phu Thanh in year 2002 (SOFRI, 2002)

Items	Demonstration (6.700 m <sup>2</sup> )			Conventional farmer (1.700 m <sup>2</sup> )		
	Amount	Price	Total	Amount	Price	Total
Fertilizer	400	3200	128.000	100	3200	320000
Organic fertilizer	4000	900	3.600.000			
Pesticides			372.000			250000
Petroleum			562.000			80000
Labor			2.820.000			970000
Cost			8.634.000			1620000
Yield	6052 (13551/ ha)		20.624.000	2660 (15647/ ha)		8176000
Real income			11.989.500			6556000

Note: Conventional farmer was compared at Tan Phu Thanh. Can Tho

The economical analysis on demonstration compared with conventional orchard show in table 5. The real income on demonstration was low because they had to cut down and replanted 168 new plants. It will begin harvest three year after. At the moment they harvested only on area nearly 4.500 m<sup>2</sup>. In addition low yield of demonstration because of a mixing orchard, and the payment of demonstration also including for the young trees, so the cost was higher than conventional more than 5 times while the income was only two times higher than.

#### 4. Conclusion

The green ant colony could locate and develop well on inter-cropping orchard of sweet orange with mango, durian, hot plum and Oecophylla. This technique could applied along with horticultural mineral oil spray to control citrus psylla (*Diaphorina citri*) and citrus leaf miner. In addition, use of organic fertilizer could improve the fruit quality particularly its brix content. Environment, yield and fruit quality could be improved by this IPM and INM. the economic analysis, however, should be done after another 3 years waiting for the fruiting of the replaced of diseased plants to prove the economical efficiency of the technology in the demonstration.

## References

- Huynh, T.D, Trac. K. L, Nguyen. N. T and Nguyen. D.T., 1995. Preliminary results on Pests and diseases investigation in Mekong Delta. SOFRI Research report to the ministry of Agriculture and food industry. P 50-54.
- Nguyen, T.T.C, Le. Q.D, Nguyen. V.H., 1998. The important of key pests attack in citrus, durian, Longan and mango in Mekong Delta (in Vietnam) In: The First symposium on Fruit Production in Mekong Delta focusing on Integrated Pest Management, Cantho University. Viet Nam. 25<sup>th</sup>, Feb 1998.
- Nguyen T.T.C., 1999. Research on the effect of yellow ant (*Oecophylla smaragdina*) on citrus quality. Report of Second IPM workshop on fruit production, Cantho University, Date 3<sup>rd</sup>, March.1999. (In Vietnamese, unpublished).
- Aubert, B. 1984. The Asian and the Africa psylla *Diaphorina citri* Kuwayama, *Trioza erytrae* (Del Guercio) (Homoptera: Psyllidae) in the south west of Saudi Arabia, proposal on integrated control program. In: Proceeding of the 4<sup>th</sup> International Pacific Conference on Citrus Rehabilitation, Chiang Mai, Thai land, 4 - 10<sup>th</sup> Feb. 1990. FAO-UNDP. RASS/ 86 / 022. Regional Project. p 240-245.
- Aubert, B. 1987. *Trioza erytrae* (Del Guercio) and *Diaphorina citri* Kuwayama (Homoptera: Psyllidae), the two vectors of citrus greening disease: biological aspects and possible control strategies. *Fruits* 42 (3): 149-162.
- Capoor, S.P, Rao, D.G & Viswanasth, S.M. 1967. *Diaphorina citri*, a vector of the greening disease of citrus in India. *Indian Journal of Agricultural Science* 37: 572-576.