IPM on Citrus with An Emphasis on Citrus Psyllid Control in Tan Phu Thanh Village

Le Quoc Dien, Do Hong Tuan, Nguyen Duong Tuyen and Pham Tan Hao

Southern Fruit Research Institute, Longdinh, Chauthanh, Tiengiang, Vietnam

Abstract

IPM on 6,700 square meter of sweet orange –crop in Tan Phu Thanh, Chau Thanh, Can Tho was conducted with improved farming (wind break, pruning of diseased branches, free disease feedling, sanitary…) biological control with ants; chemical control with mineral oil to control effectively psylla. This research showed that ant colonies and mineral oil could be practiced well together for effective the management of leaf miners, mealy bug. In addition, organic fertilizer could increase fruit brix and performance made better fruit quality.

Introduction

Hoang longbin (HLB) is a serious disease which caused considerable loss for citrus industry in the Southern of Vietnam. The disease spread out through vegetative propagation and, beside that, citrus psyllid (*Diaphorina citri* Kuw*ayama*) plays an important role as the vector of 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 showed that there was high population and wide distribution of psyllid in the area. Therefore, to enhance the progress of citrus improvement, citrus psyllid must be efficiently controlled.

This IPM practice was conducted at Long An, Tan Phu Thanh village in an area of 6,700 m^2 planted with 500 Mat orange trees with the following objectives have been done in three years:

- To identify the pests, diseases and their natural enemies on citrus at Tan Phu Thanh village
- To control citrus psyllid (*Diaphorina citri*) by IPM program application though green ants *Oecopylla smaradina* (Fab.) and horticultural mineral oil (HMO) spraying.
- To develop an IPM along with a training program for citrus growers at Tan Phu Thanh village.

Materials and Methods

Location: Long An, Tan Phu Thanh village, in the 4- years -old orchard, area cover 6.700m^2, cultivars: sweet orange, density 500: trees in total area, the high of the tree ranging from 2,5 to 3m and canopy was about 2,5 diameters.

Duration*: 2001-2003*

Orchard management: Main activities were:

-Pruning after harvesting

-Organic fertilizer application

-Minimize chemical fertilizer and pesticide application

-Good drainage management

Orchard and fruits were done well sanitary.

Integrated Pest Management (IPM):

-Monitoring schedule weekly on the key pests and diseases of citrus

-Establishing the green ant colony to protect against citrus pests for reducing of pesticides application

-Selection of pesticides to maintain well green ant colony.

-Citrus psyllid control by applying horticultural mineral oil (HMO), Applaud and Actara.

-Recording the presence of psyllid by monitoring, trapping by yellow sticky trap and attractant plant (*Murraya paniculata*).

-30 samples were vacuumed in each sweet orange orchard fortnightly at Tan Phu Thanh Can Tho in third year. (demonstration and conventional farmer practice)

-Establishing wind-break.

Observations:

-Every week the key pests and diseases population include citrus psyllid, citrus leaf miner, citrus aphids, mealy bug, scale, thrips and citrus canker disease were recorded by monitoring 30 trees.

-Fortnightly to vacuum 30 samples in each orchard and they were analyzed in the lab (February to September)

-Hoanglongbin was detected by symptom observation and PCR test once per year during the dry season (March to April)

-Quality of fruit: (color, mite/thrips blemish, scale infestations, canker infestations)

-Yield: (fruit number, fruit weight)

Results and Discussion

Citrus psyllid was recorded to be available year around under climate conduction at Mekong Delta. which is easily to reach high population. In the demonstration, the observed psyllid population was very low as only

0.01 – 0.02 psyllid/plant. It usually presents on attractant plant (*Murraya paniculata)* and sweet orange at the end of orchard but only small population of psyllid and adult appeared. Eggs and larvae were not found on young shoots of sweet orange and of attractant plants. Perhaps, it was removed from nearby orchard of King Mandarin. Adult was recorded to arise four times in 2003. In year 2003, the times of psyllid appearance was less than year 2001 and 2002, the number of psyllid was very low (0.02 psyllid/shoot). Total of 5 yellow stick traps have also been set up in orchard. Data recording and traps replacing were done every two weeks but not many insects was trapped.

Beside that, citrus leaf-miner had similar result as citrus psyllid. In 2001, there was two peaks of population: in March and August with percentage damage were estimated as 7.2% and 5.2%. And in the year 2002, there was only peak development of leaf miner with the damage was 3.5%. And in the year 2003, there was only peak and decrease 1.2%. It was also less damage than that of the last two years (Fig 1).

The decline of these pests could be explained by the good result of green ant usage and application HMO to controlling. It was evident that the green ants could control citrus psyllid and citrus leaf miner and thrips population in orchard since density of the colony of green ant to be recorded with population to be 71 individuals per one minute per one way of ant on plant.

Integrated Pest Management on demonstration

Although pests in both orchards appeared one more times per year but density of pests in demonstration sweet orange was lower than that of in conventional cultivation. Pests obtains in a trap of conventional orchard were considerably high in comparison with one of the demonstration on sweet orange, suggesting the good result of green ant usage and spray HMO (D.C Tron-Plus). Hence, it could be said that green ant, HMO and Actara in an IPM could control citrus psyllid, citrus leaf-miner, thrips, mite, mealy-bug, scale and aphid very effective.

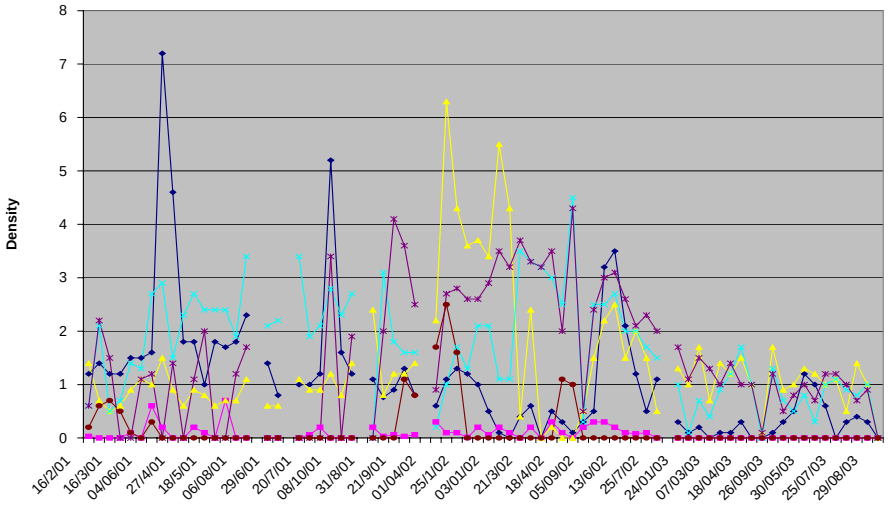

Fig 1: Population of pest on the demonstration of sweet orange at Tan Phu Thanh, Can Tho (2001 to 2003)

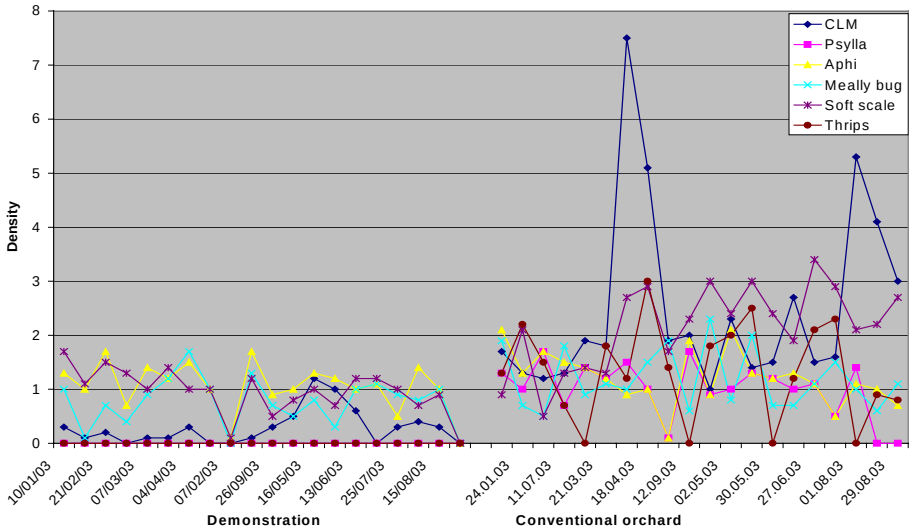

Fig 2: Population of pests was compared between demonstration sweet orange and conventional practice at Tan Phu Thanh, Can Tho in the year 2003

Table 1: Biodiversity of species on sweet orange in the demonstration site (SOFRI, 2003)

No	Order	Number of individuals	
		Conventional farmer	Demonstration
1	Colembola	213	37
2	Ephamoroptera	-	5
3	Blattoidae	3	1
4	Orthoptera	1	7
5	Psocoptera	1	1
6	Homoptera	39	117
7	Heteroptera	17	9
8	Thysanoptera	1	1
9	Neuroptera	-	7
10	Coleoptera	7	67
11	Diptera	311	171
12	Lepidoptera	-	5
13	Ants	51	162
14	Other Hym	81	43
15	Aranedae	52	117
16	Acari	1	12
17	Trichoptera	-	1
18	Gastropoda	-	15
19	Other sp1	-	1
20	Other sp2	-	1

Note: 30 Samples were collected by vacuum in each orchard

Regarding to citrus aphids, mealy bug and scale population. The result showed that the population of key pests in the demonstration orchard in 2003 was lower than that of last tow years (2001 and 2002). Beside

the IPM, impact of the cultural practices was proved to enhance the trees health, increasing the plant tolerance. The green ant was really a good key element on integrated pest management together with HMO spraying. Biodiversity of the pests insect species in demonstration orchard has been compared with conventional orchard in Tan Phu Thanh Can Tho. The result showed that about 20 orders of arthropod were collected on demonstration orchard while only 13 orders could record in the conventional orchard.

Table 2: Green ant population on sweet orange orchard at Tan Phu Thanh, Can Tho

Tree kinds	August 2002		August 2003	
	Total nests	Nests/tree	Total nests	Nests/tree
Sweet orange	300	0.4	1875	2.5
Mango	84	12	119	17
Calophyllum	12	4	144	12
Durian	45	3	99	6.6
Plum tree	40	4	280	7
Total	481		2517	
Nest size		2.5-3.5		20-37 cm
Population		30/min		87/min

At the beginning with small number consisted of 3 nests, after that the colony of green ant has been developed quickly, thirty seven nests were from February to September of year 2001 and developed to two thousand five hundred seventeen nests on September of year 2003. In three years, the colony of green ants developed approximately 839 times as compared with time of initial establishment the population of green ant higher than three times because of a lot of temporary small nests for staying of ant workers. They built their nests to every plant and arise every where even on land surface of the orchard.

In year 2002, density of nest on sweet orange was about 0.4 nest/tree but that was intensified to 2.5 nests/tree in year 2003. Having small nests on replanting in the first year that nests were temporary nests for staying of ant workers but on old sweet orange has fixity nest very large with presence the queen ant and this good host for ant colony to develop at season to construct new nest when having to cut out.

Density of ant was set down 71 individuals per one minute per way of ant on plant was higher last year. With high density of ant they could feed the insects and its eggs and protect plant well. In third year, fortnightly monitoring psyllid of adult were found on young shoot of a few plant at the end in orchard.

Sometimes, adult of psyllid were collected from yellow stick traps but a tenuous amount of psyllid and that are yellow stick traps side of orchard. Evolution of green ant is antagonistic psyllid and also mite. Beside that, citrus leaf-miner, thrips and citrus butterfly were very low in population (Fig 1 and Table 2).

Quality of fruit on demonstrations was analyzed and compared with a conventional orchard 4 year-olds located nearby the demonstration. Weight and the brix of fruit were not significant different with each other but sugar contain of fruits in demonstration orchard was significantly higher than that of the conventional orchard The diseases in demonstration orchard was lower incidences than that of the conventional orchard. This is good result of organic fertilizer application and pruning trees after harvesting fruits.

Table 3: Performance of fruit quality on IPM and other orchard (SOFRI, 2003)

Items	To be analyzed in year 2002		To be analyzed in year 2003	
	Demonstration	Conventional orchard	Demonstration	Conventional orchard
Blemish of fruit	3.58 ns	3.35 ns	3.81 ns	3.57 ns
Weight (g)	165.23 ns	155.93 ns	166.21 ns	158.27 ns
Brix (%)	9.2*	8.72*	9.3*	8.73*
Scab (%)	6.7	3.3	6.1	3.7
Canker (%)	10	13.3	7	14.1
Mite (%)	0	23.3	0	24.7
Thrips (%)	53.3	40	43.22	44.21

Note: 30 fruits each orchard were randomly collected in every harvest.

Conventional practing orchard at Tan Phu Thanh Can Tho

Blemish of fruit following scale 1-5

Others pests such as thrips and mite damage could not be seen on fruits harvested from the demonstration orchard but they are found abundance in conventional orchard. Although, a lot of pesticides were applied on one. Amblings, insects and mites are antitoxin with pesticides when the farmer spray one kind of pesticide for consecutive times. When spray insecticides frequently, a lot of enemies were obviously killed.

Table 4: Major farming practices have been done in the orange demonstration orchard at Tan Phu Thanh.

No	Activities	Performance	Dated
1.	Surveyed to check the infested trees by symptoms	168 trees	2/2/2001
2.	Cutting the infested trees after sprayed insecticides to control citrus psyllid (two times after harvested)	168 trees	07/2001
3.	Replanted free diseases seedling provided by SOFRI	168 trees	12/2001
4.	Monitoring schedule weekly on the orchard		02/2001
5.	Set up yellow sticky traps	5 traps	2/2/2001
6.	Planting *Murraya paniculata* around the orchard (attractant agent to citrus psyllid)	100 plants on 4 sides of the orchard	21/07/2001
7.	Established green ant colonies	37 nests of green ant were transferred	3/2001
8.	Removing the infested branches and fruit of citrus canker	Frequently	-
9.	Developing and maintaining the colony of green ant	2517 nests of green ant	08/2003
10.	Fortnightly to vacuum insects	-	02/2003
11.	Pruning trees after the last harvest fruits	-	-
12.	Planting plum-tree for the wind-break trees in the remaining side of the orchard	-	6/01
13.	Fertilizer for year 2003	450 kg	-
	➢ Chemical fertilizer	4.500 kg	-
	➢ Organic fertilizer		

All the infested trees with typical symptoms of HLB were cut down and moved out after the cover spray insecticide to ensure no psyllid presented in the infested trees and replant young seedling to be applied from SOFRI in the first year. The works prune off branches, to apply both kind of fertilizers and HMO spraying, to develop and maintain the colony of green ant were well done each year. Beside that, the water was good managed in season of flood. In addition, orchard sanitary was done by removing all the infested part of tree as citrus canker damaged twigs, leaves and fruits were included.

Table 5: Economical efficacy on demonstration of sweet orange at Tan Phu Thanh in year 2003

Items	Demonstration (6.700 m^2)			Conventional farmer (1.700 m^2)		
	Amount	Price	Total price	Amount	Price	Total price
Fertilizer	400	3200	1.280.000	150	3200	480.000
Organic fertilizer	4500	900	4.050.000			
Pesticide			400.000			300.000
Petroleum			344.000			100.000
Labor			3.000.000			1.120.000
Cost			9.074.000			2.000.000
Yield	10.020	3.300	33.066.000	3.050	3.300	10.065.000
Real income			23.992.000			8.065.000
Income/ha			35.808.955			47.441.176

Note: Conventional farmer was compared at Tan Phu Thanh Can Tho and a monetary unit is VND

The economical analysis on demonstration compared with conventional orchard show in table 5. The real income on demonstration was higher last year, income in 2002 only 11.989.500 VND. In third year, all-in-all tree were replanted in the first year having been beginning harvest but low income of demonstration as that only income of sweet orange when it was compared with conventional orchard because of a mixing orchard and the payment of demonstration also altogether tree of orchard (sweet orange, durian, mango, plum tree, calophylum).

If revenue was added with income of trees of a mixing orchard, incoming of demonstration was higher than conventional orchard because benefit of trees of a mixing orchard was 17.000.000 VND when real revenue on demonstration was 52.808.955 VND. Otherwise, total surface on demonstration was planted sweet orange about 4.500 m^2, if income was compared with genuine area cover to be planted together sweet orange then revenue of demonstration higher than about 750.000 VND/1000 m^2.

Conclusion

The citrus industry in the world is going to through a period of substantial growth and change, due to development and expansion of world and export markets. Consumers want good quality of fruit that is clean, attractive, high quality, good tasting and safe to eat.

The green ant with HMO spraying was really a good key together and application organic fertilizer the need for universal adoption of IMP by citrus growers in their quest international competitiveness and sustainability.

Literature Cited

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. 25th, Feb, 1998.

Nguyen TTC., 1999. Research on the effect of yellow ant (*Oecophylla smaragdina*) on citrus quality. Report of Second IPM workshop on fruit production, Cantho University, Date 3rd, March.1999. (in Vietnamese, unpublished)

Aubert, B. 1984. The Asian and the Africa psyllid *Diaphorina citri Kuwayama*, *Treoza erytreae* (Del Guercio) (Homoptera: Psyllidae) in the south west of Saudi Arabia, proposal on integrated control program. In: Proceeding of the 4 th International Pacific Conference on Citrus Rehabilitation, Chiang Mai, Thai land, 4 - 10 th Feb . 1990. FAO-UNDP. RASS/ 86 / 022. Regional Project . p 240-245.

Aubert, B. 1987. *Trioza erytreae* (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, SP, Rao, DG & Viswanasth, SM. 1967. *Diaphorina citri*, a vector of the greening disease of citrus in India. *Indian Journal of Agricultural Science* 37: 572-576.

Tóm lược

Mô hình phòng trừ tổng hợp sâu hại (IPM) trên cam mật được tiến hành với diện tích 6.700m^2 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 hoá học với dầu khoáng cùng với việc phòng trừ tổng hợp rầy (côn trùng trung gian truyền bệnh vàng lá Greening) và quản lý tổng hợp vườn cây có múi.

Các kết quả cho thấy có thể thiết lập và phát triển kiến vàng trong vườn kết hợp phun dầu khoáng để phòng trừ sâu vẽ bùa, rệp sáp, rầy chổng 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, loét, nhện, bù lạch. Mô hình thành lập được ba năm, từ 2001 đến 2003 đã thu được một số kết quả rất khả quan.