INFESTATION OF POMELO FRUIT BORER *Citripestis sagittiferella* (Moore) (Lepidoptera: Pyralidae) IN VIETNAM AND THE EFFECT OF COMPACT FLUORESCENT LAMP AS A REPELLENT

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1. INTRODUCTION

- Pomelo culture has significantly played a key role in the Mekong Delta economy

- The Mekong Delta accounted for about 85% of the Viet Nam citrus production (MARD, 2010).

- 2011, pomelo fruit borer *Citripestis sagittiferella* (Moore) has started spreading and causing severe damage across all planted areas in Mekong delta as Ben Tre, Tien Giang, Soc Trang, Vinh Long, Bac Lieu, Can Thơ city and spacial và specially on Hau Giang (PPD, 2013).

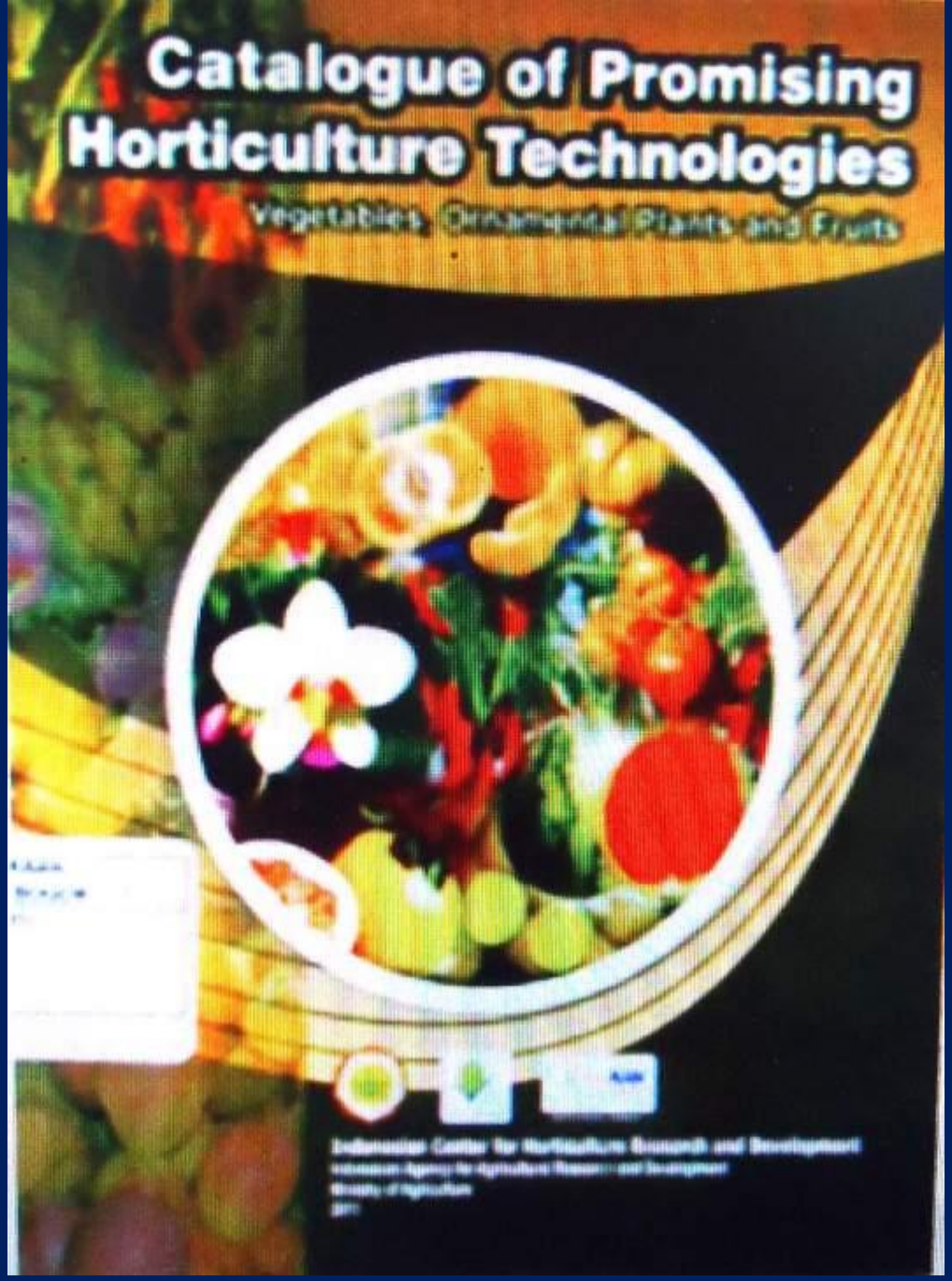
- This specices also has started spreading Indonesia, Philippines, Thai Land and Malaysia.

Control fruit borer ?

❖Insect parasite, Rhoptromeris sp. (Hymenoptera: Eucoilidae) plays an important role in the control of *Citripestis sagittiferrella* on lemon at University Pertanian Malaysia orchard.

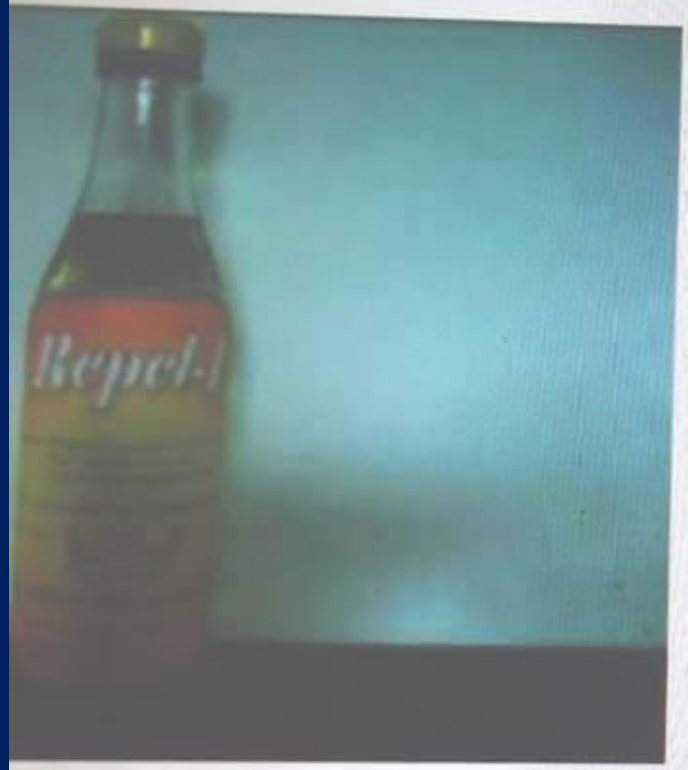
❖At 24% larval parasitism was estimated from larvae collelcted in the field. Field studies to evaluate the effectiveness of malathion 50 EC emulsifiable concentrate sprayed to trees at 0.1% a.i. active ingredient show that the percentage of fruits attacked was nuch more higher in the sprayed block than that of the unsprayed block (Hussein and Rahman (1981).

❖Insect visual systems to find out about the abililty to detect objects, colours, movement, prey or conspecifics using the properties of light provides an incredible spatial advantage as critical information is collected and responded to from an extended scene. Visual systems of insects have adapted to operate in a wide range of intensities and spectrally diverse visual conditions, such as diurnal and nocturnal periods, dense forests or aquatic enviroments (Briscoe and Chittka, 2001).



Repel product (2011)

Repellent formulation for Fruit Borer Pest (*Citripestis sagittiferella*) on citrus



- Repellent was originated from essential oil extracted from Cymbopogon nardus and mixed with liquid paraffin
- Liquid paraffin was carrier material of essential oil that prevent faster essential oil evaporation
- Superiority:
  - Environmental friendly due to using natural resources availability surround us
  - Have high effect to control and reduce fruit borer pest on citrus up to 70%

Status: ready used for training and extension purposes

Natural enimies

Bagging fruit

http://ecoport.org/ep?Arthropod=368199&entityDisplayCategory=Relationships

Bagging fruit

No Labor ?

?????

- The objective of this work is to describe the steps that were developed to rationnalize *Citripestis sagittiferella* control by using compact fluorescent lamp as a repellent, from the basics upto a final product that is currently sold to pomelo producers.

2. MATERIALS AND METHODS

- The survey of pomelo year-round in Chau Thanh district, Ben Tre province was carried out by interview approach directly with pre-composed questionnaires from March to June, 2012, 2013.

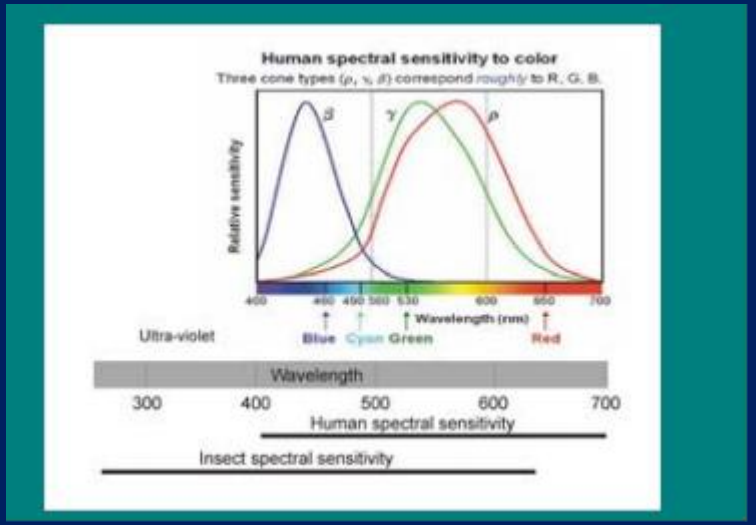
- The interviewes were growers possessing more than 2,000 square meter area of pomelo in five villages in the largest pomelo areas.

- The number of interviewed growers was 410 in total.

- Demonstrations of pomelo year-round production were implemented on “Da xanh” pomelo aging from 6 to 8 years.

Why ?

Light attractive insect ?



Cowan và Gries (2009)

- Field experiment: 6 orchards set compact fluorescent lamps tube treatment and non compact fluorescent lamps treatment sites relied on conventional fungicides without pesticides application, but were routinely sprayed with growth regulator, N-P-K fertilizers with animal matures to to supplement nutrient were applied in both the treatment and non treatment sites.

- In addition to 6 orchards set compact fluorescent lamps tube treatment, a range of set time 17:30 PM to 6:00 AM was used in the treatment site for the prevent adults laid egg, one compact fluorescent lamps tube was placed one tree, tubes put in canopy center, as in the other sites.

- For each site, coordinate data were recorded by using a handheld logger device. Experiments were observed at intervals every month on the same location.

Location of experiment

- Nhan Thanh villeage, Chau Thanh Dist, Ben Tre Province and Long An villeage, Chau Thanh Dist, Tien Giang province.

- Data analysis: Student t- test were performed to assess prevent fruit borer between compact fluorescent lamps treatment and non compact fluorescent lamps treatment. T- test was undertaken using using the SAS version 8.0 (SAS, 1999).

Levels of infestations

- 100 fruits were selected and remarked labels on each fruit, 100 fruits were recorded fruit infestion caused by fruit borer.

3. RESULT AND DISCUSSION

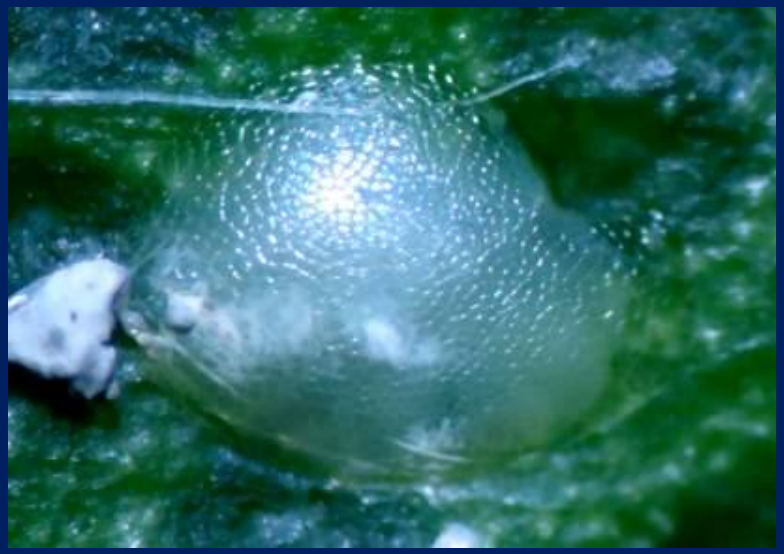
Understand fruit borer

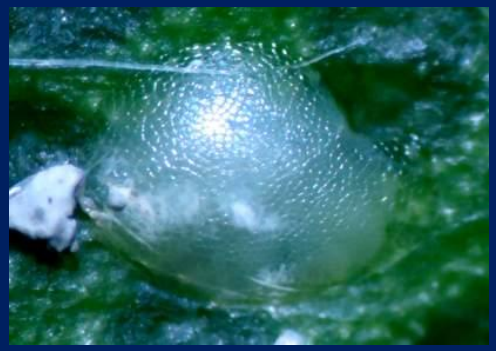
*Adult: 11-13 mm

(Nguồn: Kuroko và Lewvanich, 1993)

Correct identification of the pest

Lay egg at night





Egg 5-6 days

Larva stage	Size (mm)	
	Head	Body
1 star	0,33	1,8-5
2 star	0,62	5-10
3 star	1, 10	10-18
4 star	1,40	18-22

1 star

4 star

Larva
10 – 11 days

2 star

3 star

Pupa
(8-9 days)


Citri

Lifecycle of pomelo borer

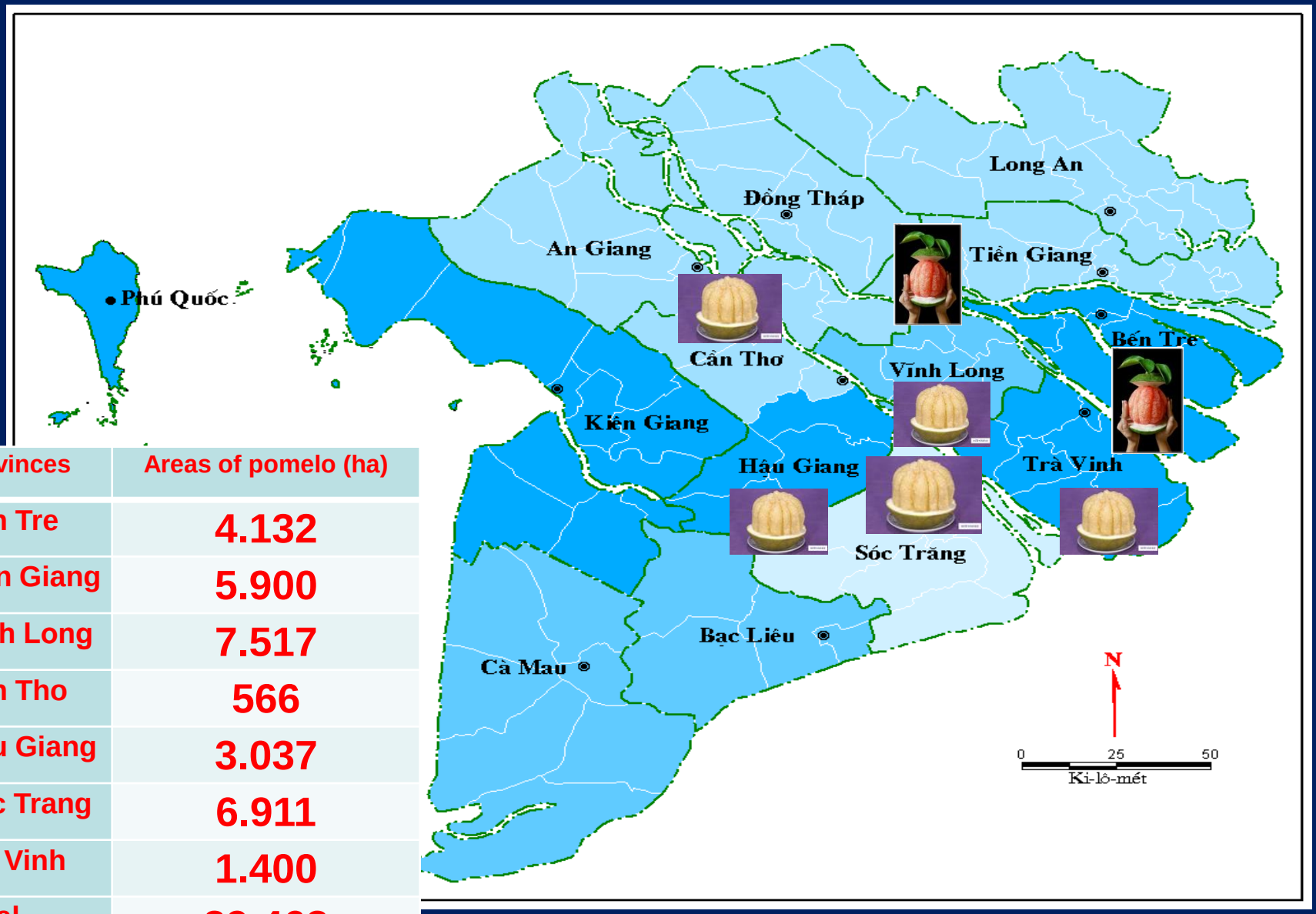
28.15 ± 3.64

Symtom of fruit borer

1 star (1.30-2.00 h)

Table 3: The cycle of *Citripestis sagittiferella* (T^0C= 26 ± 1; H% = 60 ± 10)

Stage	Life cycle	
	Fluctuation of duration (day)	**Duration (day)**
Egg	5-6	**5.3 ± 1,00**
Larva 1	2-3	**2,5 ± 1,29**
Larva 2	2-3	**2,2 ± 1,00**
Larva 3	3-4	**4,4 ± 1,58**
Larva 4	4-6	**5,0 ± 1,28**
Pupa	9-11	**10,2 ± 1,1**
Life cycle		**28.15 ± 3.64**
Male: Female	**-**	**1:1**

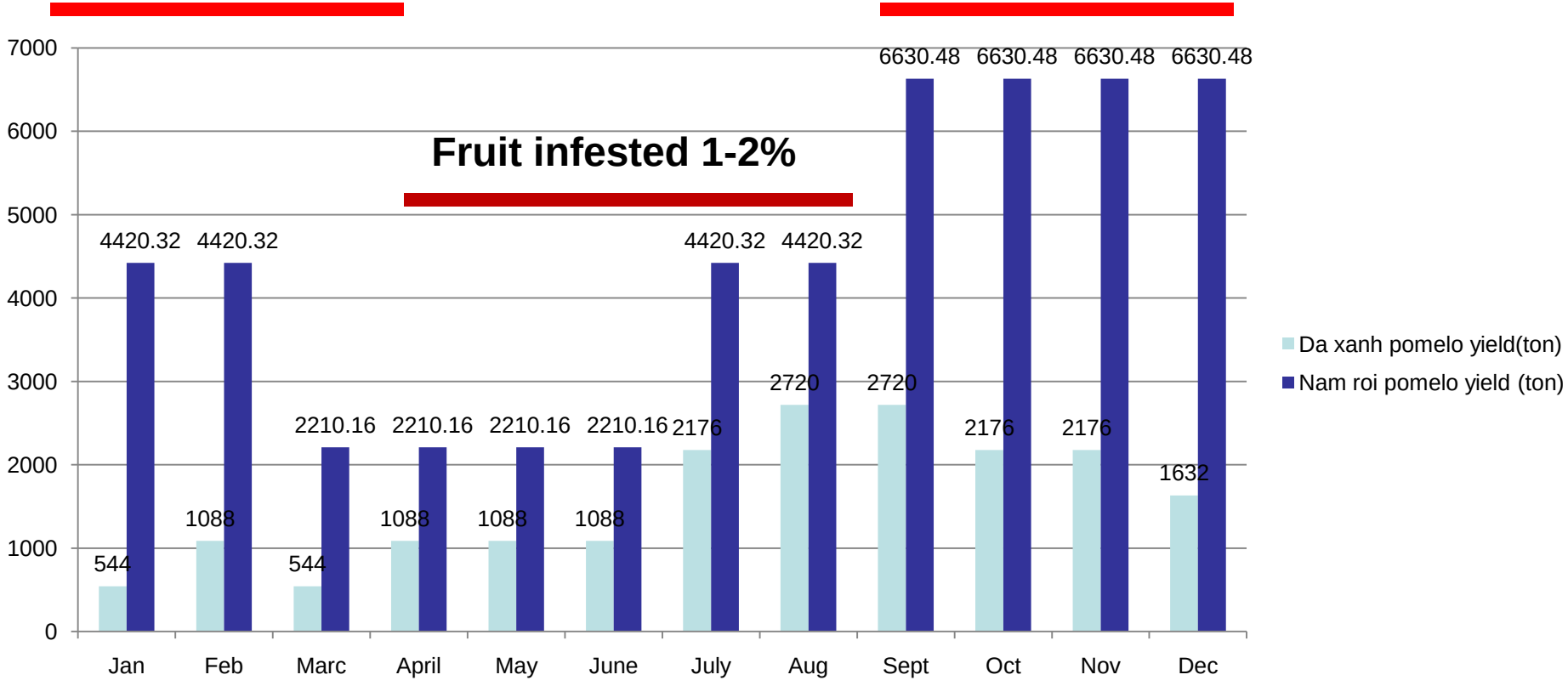


Provinces	Areas of pomelo (ha)
Ben Tre	4.132
Tien Giang	5.900
Vĩnh Long	7.517
Can Tho	566
Hau Giang	3.037
Soc Trang	6.911
Tra Vinh	1.400
Total	29.463

Zones of pomelo in Mekong delta

Fruit infested 25-100%

Fruit infested 19-100%



The period of pomelo fruit season in Mekong delta

Table 1: Percentage (%) of surveyed orchards damaged pomelo fruit borer in different provinces of Mekong Delta

Provinces	Areas of pomelo (ha)	Areas infested (ha)	% infested fruit
Ben Tre	4.132	717,9	17.4
Tien Giang	5.900	2.120	30.9
Vĩnh Long	7.517	3.739	49.7
Can Tho	566	368	65
Hau Giang	3.037	2.450	80.1
Soc Trang	6.911	1.678	24.3
Tra Vinh	1.400	1.120	80.0
Total	29.463	12.192,9	-

Source: Plant protection Department (PPD), 2013

Control fruit borer by growers in Chau Thanh, Ben Tre province

Control method	Year 2012		Year 2013	
	Number orchard	Percentage (%)	Number orchard	**Percentage (%)**
Pesticide spray	200	48.8	50	**14.63**
Bag fruit	86	21.0	298	**72.68**
Green ant	0	0.0	15	**3.66**
Camphor repellent	3	7.0	25	**6.10**
Not practice	121	29.5	12	**2.93**
Total	**410**	**100**	**10**	**100**

Source: Survey orchards in Chau Thanh, Ben Tre province , 2012 to 2013

3.4 Studies in field

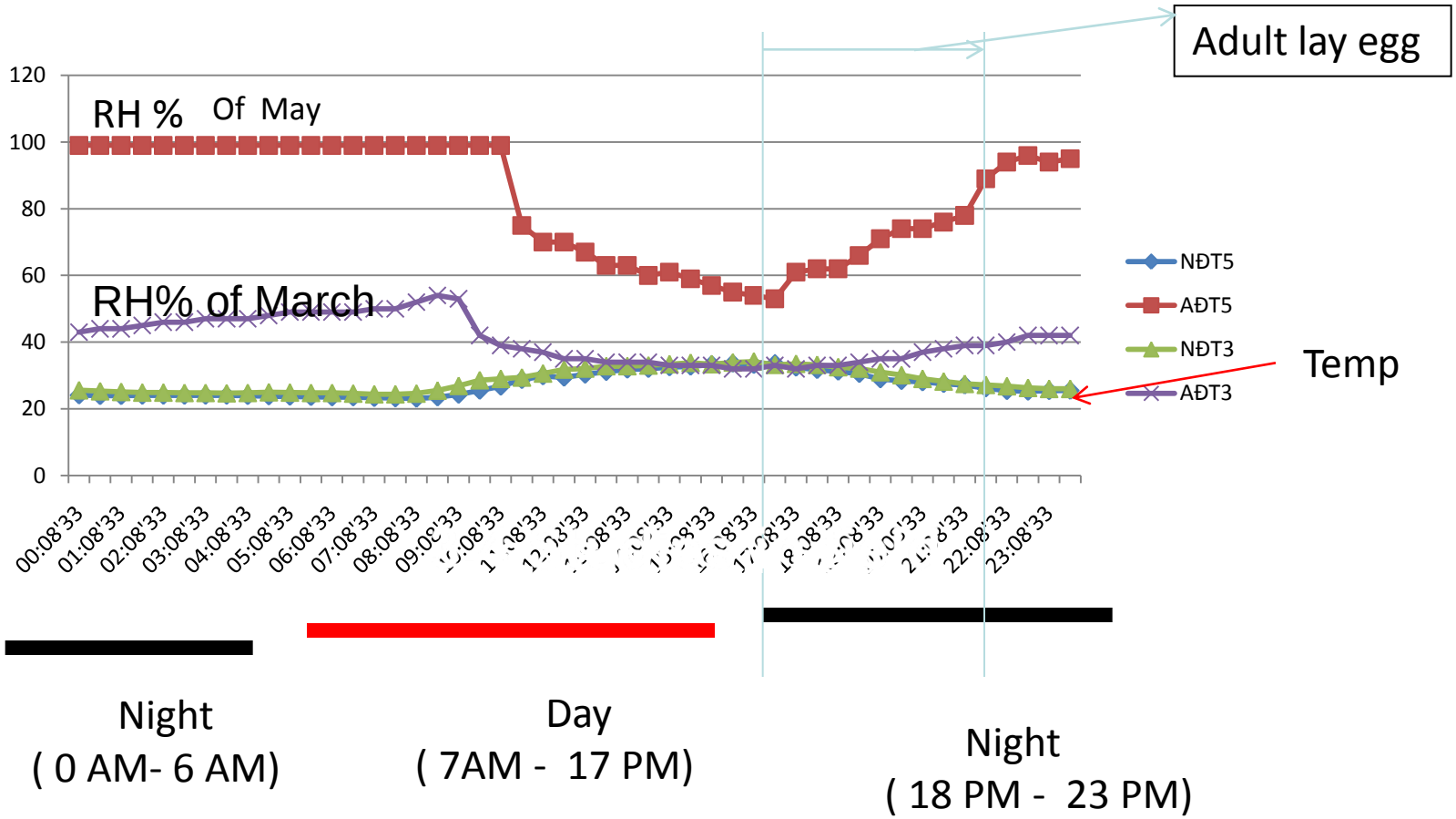


Figure 4: Mean time temperature and relative humidity (RH%) in six orchards in Ben Tre Province on 1 - 30 March and May 2013. Temperature and relative humidity (RH%) were recorded using data loggers set at every one hour.

Fruit infested: 24-60% (March)
Fruit infested : 2- 6 % (May)

3.4 Studies in field (cont)

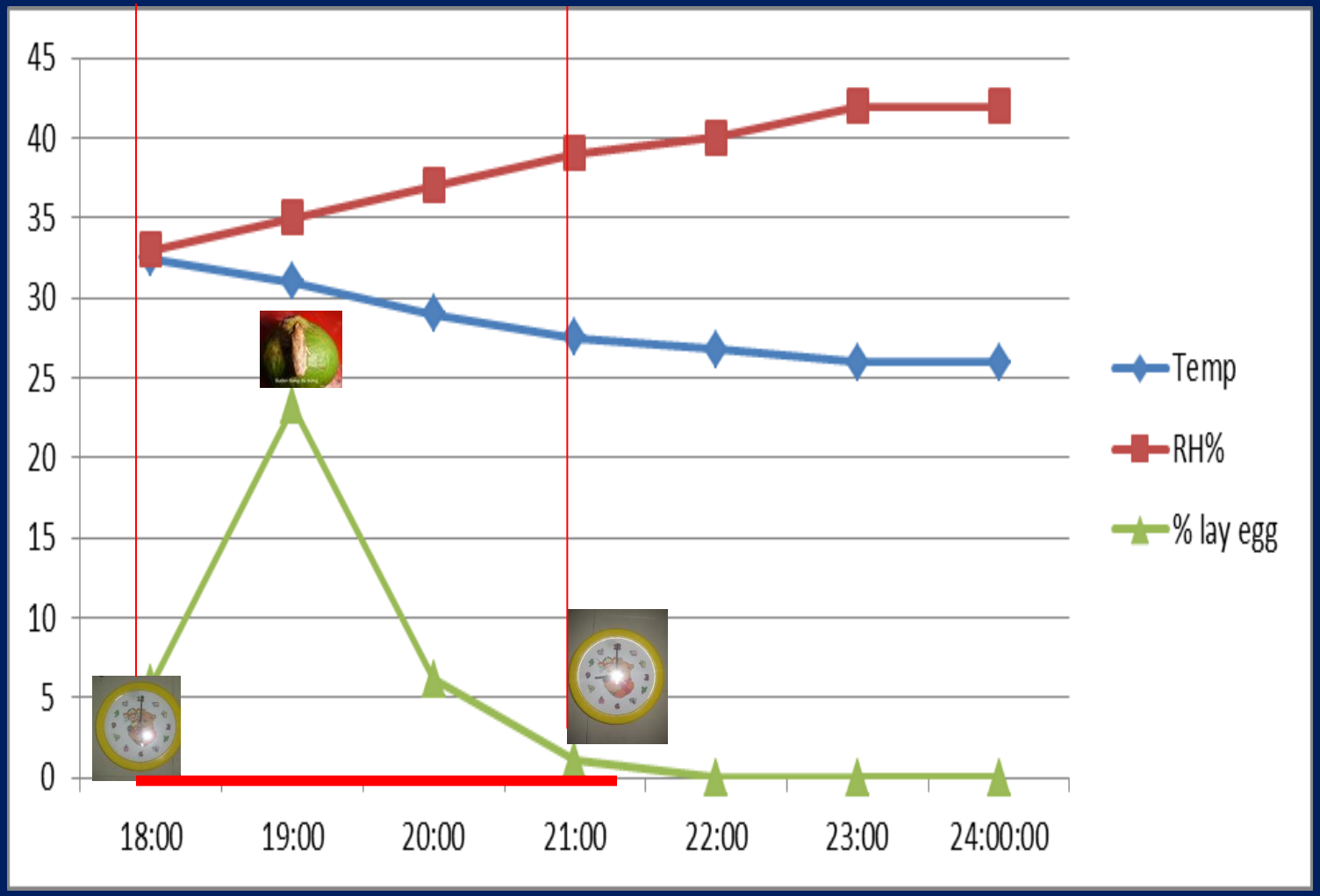


Figure 5: Mean time temperature and relative humidity (RH%) in six orchards in Ben Tre Province on 1 - 30 March 2013. Temperature and relative humidity (RH%) were recorded using data loggers set at every one hour

Compact fluorescent lamps prevent fruit borer laid egg in pomelo orchard

Table 4: Comparison of percentage (%) number fruit infested recorded monthly per 100 fruit in 6 six orchards in Chau Thanh, Ben Tre province from (oct, 2012 to December, 2012)

Months set Compact fluorescent lamps	Number fruit observation	Compact fluorescent lamps treatment (%)	No compact fluorescent lamps Treatment (%)	P	T "test"
October, 2012	100	0.0	12.13	0,0001*	10.66
November, 2012	100	0.0	23.30	<0,0001 *	11.55
December, 2012	100	0.0	32.50	<0,0001 *	23.29

Table 5: Comparison of percentage (%) number fruit infested recorded monthly per 100 fruit in 6 six orchards in Chau Thanh, Ben Tre province from (Jan, 2012 to March, 2012)

Number months set Compact fluorescent lamps	Number fruit observation	Compact fluorescent lamps treatment (%)	No compact fluorescent lamps Treatment (%)	P	T "test"
January 2013	100	0.0	9,13	<0,0001*	7.83
Febuary 2013	100	0.0	20.30	<0,0001*	12.13
March 2013	100	0.0	23.13	<0,0001*	16.52

Table 6: Comparision of cost and benefit per hectare of pomelo production between compact fluorescent lamps treatment and non treatment one

Description	Compact fluorescent lamps treatment			Non treatment		
	Quantity	Unit price (VND)	Amoun (VND)	Quantity	Unit price (VND)	**Amoun (VND)**
Chemical fertilizer (kg)	3.750	10.000	37.500.000	3.750	10.000	**37.500.000**
Organic fertilizer (kg)	3.500	3.000	10.500.000	3.500	3.000	**10.500.000**
Insecticides and fungicide (litre)	4	500.000	2.000.000	10	500.000	**5.000.000**
Labor (days)	300	120.000	36.000.000	450	120.000	**54.000.000**
Compact fluorescent lamps (tubes)	200	43.750	8.750.000	0	0	**0**
Electrical wiring	400	8.600	3.440.000	0	0	**0**
Fruit production (kg)	14.000	55.000	770.000.000	10.640	35.000	**372.400.000**
Net profit			**671.810.000**			**265.400.000**

Farmer happy with the usage of compact fluorescent lamps can prevent *C. sagittiferella* from coming to the orchards and egg-laying on the surface of pomelo fruit.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

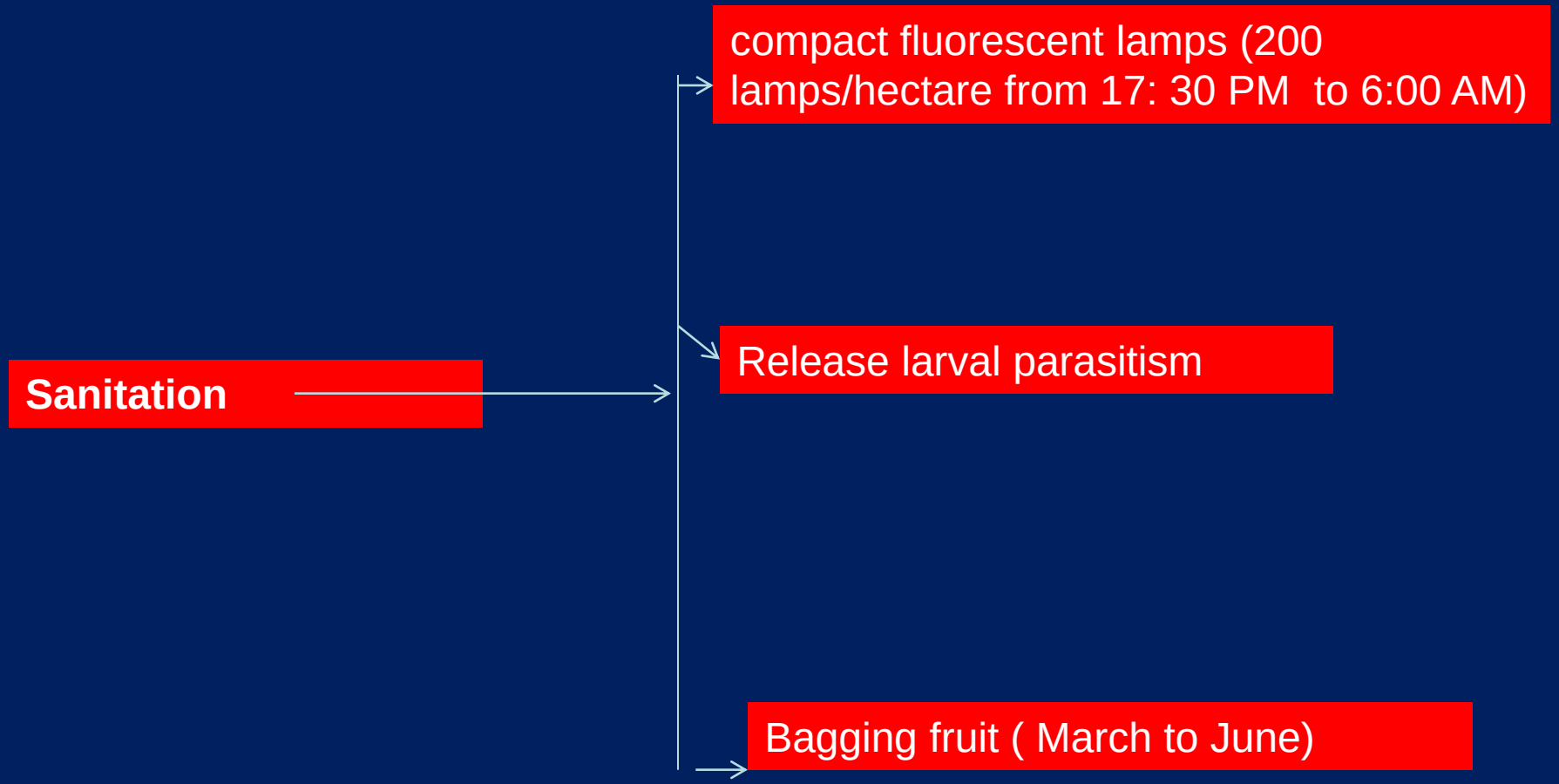
➢The study had identified that the conditions of $T^0C = 26 \pm 1$; $H\% = 60 \pm 10$, the life cycle of *C. sagittiferella* is 28.15 ± 3.64 days.

➢Field tests conducted on 6 pomelo orchards from Dec 2011- Jun 2012 in Ben Tre province recorded that three orchards were illuminated with compact fluorescent lamps (200 lamps/hectare from 17: 30 PM to 6:00 AM), no infestation from pomelo fruit borer was found while the other three ones were used without compact fluorescent lamps, the average percentage of fruits were infected, reaching to 32,50%.

➢The result shows the usage of compact fluorescent lamps can prevent *C. sagittiferella* from coming to the orchards and egg-laying on the surface of pomelo fruit.

➢The effect on compact fluorescent lamp as a repellent against pomelo fruit borer is at high interest and being experimented on bigger pomelo growth areas in Mekong delta of Vietnam.

Controling fruit borer by IPM in Mekong Delta



4.2 Recommendations

- Compact fluorescent lamps should be considered to practice in orchards, especially in rainy season which lead to reduce serious damages of fruit borer to lemon, orange fruit in Mekong Delta.
- There is a need to conduct studies on economic efficiency of compact fluorescent lamps at different periods after lemon fruit setting so as to determine the most effective ones.