BIO-EFFICACY PERFORMANCE OF DUPONT(TM) PREVATHON® 5 SC ON CONTROLLING SUGARCANE BORERS IN THE SOUTH EAST OF VIETNAM

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Abstract

DuPont(TM) Prevathon® 5 SC with the active ingredient *Chlorantraniliprole* was able to control sugarcane borers and provided long residue up to harvest. The best effective use rate from both technical and economic perspectives was drenching into the sugarcane rows 1.5 kg/ha. In addition to the lethal impact on young instars of sugarcane borers, this product indirectly helps the leaves greener, better crop vigor and growth. DuPont(TM) Prevathon® 5 SC was also safe for the population of natural enemies for sugarcane borers.

Keywords: DuPont(TM) Prevathon® 5 SC, *Chlorantraniliprole*, sugarcane, sugarcane borers, insecticides.

INTRODUCTION

The total sugarcane growing area of Vietnam was 309.400 ha and the average yield was about 64.7 tons/ha in 10.5 CCS in crop season of 2013 - 2014. This supplied 20.0 million tons of raw sugarcane to 41 mills throughout the country. In comparison with regional and global average yield, sugarcane in Vietnam had lower yield than that in Thailand with 77.3 tons/ha, and little higher than global average yield of 70.2 tons/ha (MARD, 7/2014). One of the critical reasons leading to low yield and quality is the damage of sugarcane pests, particularly borers. Annually, the damage caused by these insect pests approximately accounts for 20 - 40% yield loss (Do Ngoc Diep, 2005; Nguyen Duc Quang *et. al.*, 2011). These days, the insecticides use for controlling sugarcane borers has long been known, however, search for appropriate products in terms of good efficacy, safety for environment and natural enemies is not easy and turns to be a critical need. Recently, in the insecticides market, DuPont(TM) Prevathon® 5 SC consists of *Chlorantraniliprole*, has high efficacy on chewing insects, short pre-harvest interval, friendly for environment and helpful insects. This active ingredient owns a novel mode of action in which to be a potent activator of insect ryanodine receptors. It causes internal store depletion and leads to insect paralysis and death. In order to evaluate the efficacy of DuPont(TM) Prevathon® 5 SC on sugarcane borers including dose optimization, appropriate application methods, we conduct a trial in Tay Ninh where sugarcane is considered one of the most important crops.

MATERIALS AND METHODS

Materials

- The trial consisted of 5 treatments with insecticides and 1 untreated check:

+ Treatment 1: Prevathon® 5 SC, at 1.0 kg/ha, foliar application;

+ Treatment 2: Prevathon® 5 SC at 1.5 kg/ha, foliar application;

+ Treatment 3: Prevathon® 5 SC at 1.0 kg/ha, soil drenching;

+ Treatment 4: Prevathon® 5 SC at 1.5 kg/ha, soil drenching;

+ Treatment 5: Furadan 3 G at 30.0 kg/ha, broadcast;

+ Treatment 6: Untreated check.

Methods

The method used in the study was followed by QCVN 01-38:2010/BNNPTNT "National technical regulation on Surveillance method of plant pests" (PPD, 2010) and NIPP (1997):

Trial layout: RCBD, 3 replications.

Plot area: 33.6 m^2 (4 row with 7 m length, row to row 1.2 m).

Date of application: 06th November 2014 (90 days after transplanting),

Date of harvest: 15th Jul 2015.

Water volume: 450 L/ha for foliar application; 1.000 L/ha for soil drenching.

Sugarcane variety: VN84-4137, ratoon first season.

- Location: Material zone of Nuoc Trong Sugar JSC Company in Tan Hoi commune, Tan Chau district, Tay Ninh province.

Data collection:

+ Collect data only from 0.3 m on 2 middle rows of each plot.

+ Date of data collection: before application, 15, 30, 45, 60, 90, 120 and 180 days after application and before harvest.

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+ Millable canes, weight, plant height, sugar content before harvest.

+ Yield: weigh all sugarcanes in plots.

+ Gross margin.

RESULTS AND DISCUSSION

Components and occurrence of sugarcane borers on the trial

There were five sugarcane borers species found on this trial. All 5 species were at tillering stage, however; in both grand growth and pre-harvest, there were only 3 of them in the field. The most common borer found during the sugarcane life cycle was purple borer followed by internode borer and pink borer. Top and shoot borer could be found only in tillering stages.

Components and occurrence of natural enemies of sugarcane borer

Five main natural enemies of sugarcane borers (Table 2) were found in this trial: *Trichogramma* wasps which were egg parasitoids of top, internode borers, *Cotesia* wasps which were larval parasitoids of internode borers. In addition, two predators were also present on the field, namely ring legged earwig and yellow spine-tailed earwig. These two natural enemies mainly feed on eggs, young larvae of sugarcane borers. Except for treatment 5 (broadcast 30 kg Furadan 3G) without predators, Prevathon® 5 SC and untreated check all had parasitoids and predators in their plots.

Table 1. Components and occurrence of sugarcane borers

Crop stages	Name		Occurrence
	English name	Scientific name	
Tillering	Purple (giant) borer	*Phragmataecia castaneae* Hübner	+++
	Internode borer	*Chilo sacchariphagus* Bojer	++
	Pink borer	*Sesamia* sp.	++
	Top borer	*Scirpophaga excerptalis* Walker	+
	Shoot borer	*Chilo infuscatellus* Snellen	+
Grand growth	Internode borer	*Chilo sacchariphagus* Bojer	++
	Purple (giant) borer	*Phragmataecia castaneae* Hübner	+++
	Pink borer	*Sesamia* sp.	++
Pre-harvest	Internode borer	*Chilo sacchariphagus* Bojer	+++
	Purple (giant) borer	*Phragmataecia castaneae* Hübner	+++
	Pink borer	*Sesamia* sp.	++

** Note: +++ very often (50-75% cases); ++ often (25-50% cases); + less often (1-25% cases); - hardly ever (< 1% cases)*

Table 2. Components and occurrence of natural enemies of sugarcane in the trial at Tan Hoi, Tan Chau, Tay Ninh

Treatment	Natural enemies		Occurrence frequency
	English name	Scientific name	
1	Trichogramma wasps (egg parasitoids)	*Trichogramma chilonis* Ishii	+++
	Cotesia wasps (larval parasitoids)	*Cotesia flavipes* Cameron	+++
	Ringlegged earwig	*Euborellia annulipes* Lucas	++
	Yellow spine-tailed earwig	*Doru sp.*	+++
2	Trichogramma wasps (egg parasitoids)	*Trichogramma chilonis* Ishii	+++
	Cotesia wasps (larval parasitoids)	*Cotesia flavipes* Cameron	+++
	Ringlegged earwig	*Euborellia annulipes* Lucas	++
	Yellow spine-tailed earwig	*Doru* sp.	+++

Table 2. Components and occurrence of natural enemies of sugarcane in the trial at Tan Hoi, Tan Chau, Tay Ninh *(continued)*

Treatment	Natural enemies		Occurrence frequency
	English name	Scientific name	
3	Trichogramma wasps (egg parasitoids)	*Trichogramma chilonis* Ishii	+++
	Cotesia wasps (larval parasitoids)	*Cotesia flavipes* Cameron	+++
	Ringlegged earwig	*Euborellia annulipes* Lucas	++
	Yellow spine-tailed earwig	*Doru sp.*	+++
4	Trichogramma wasps (egg parasitoids)	*Trichogramma chilonis* Ishii	+++
	Cotesia wasps (larval parasitoids)	*Cotesia flavipes* Cameron	+++
	Ringlegged earwig	*Euborellia annulipes* Lucas	++
	Yellow spine-tailed earwig	Doru sp.	+++
5	Trichogramma wasps (egg parasitoids)	*Trichogramma chilonis* Ishii	+++
	Cotesia wasps (larval parasitoids)	*Cotesia flavipes* Cameron	+++
	Ringlegged earwig	*Euborellia annulipes* Lucas	-
	Yellow spine-tailed earwig	*Doru sp.*	-
6 (UTC)	Trichogramma wasps (egg parasitoids)	*Trichogramma chilonis* Ishii	+++
	Cotesia wasps (larval parasitoids)	*Cotesia flavipes* Cameron	+++
	Ringlegged earwig	*Euborellia annulipes* Lucas	++
	Yellow spine-tailed earwig	*Doru sp.*	+++

** Note: +++ very often (50-75% cases); ++ often (25-50% cases); + less often (1-25% cases); - hardly ever (< 1% cases). UTC: Untreated check*

Incidence and Severity damage

Before application, the incidence of damaged plants was similar in all treatments. At 30 – 120 days after application, this incidence declined remarkably on Prevathon® compared to untreated check, particularly treatment 4 (drenching 1.5 kg Prevathon® 50 SC), followed by treatment 2 (foliar application 1.5 kg Prevathon® 50 SC) and treatment 3 (drenching 1.0 kg Prevathon® 50 SC, Figure 1).

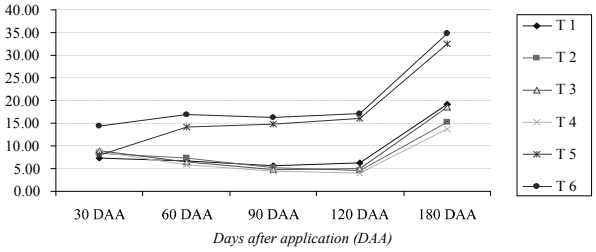

Figure 1. Incidence (%) development

Thirty days drenching application of 30.0 kg Furadan 3 G (treatment 5), the damage incidence decreased similarly to Prevathon® 5 SC. However, at 60 – 120 days after application, this figure slightly decreased (Figure 1).

The severity of damage from all treated plots was lower than that from UTC. Among them, the lowest was treatment 4 (1.28%), followed by treatment 3 (1.41%), treatment 2 (1.45%), treatment 1 (1.64%) and treatment 5 (3.17%) compared to UTC (3.25%) (Figure 2).

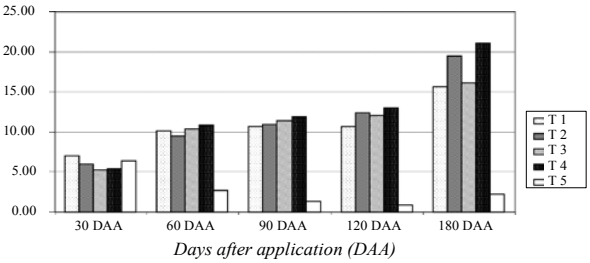

Figure 2. Incidence (%) vs. UTC

**** Discussion:***

- The control efficacy on sugarcane borers of Prevathon® 5 SC was better than Furadan 3 G and UTC. The best rate was 1.5 kg/ha. The drenching method was superior to foliar application (Figure 3).

- The long lasting was also better when using Prevathon® 5 SC comparing which Furadan 3 G (Figure 3).

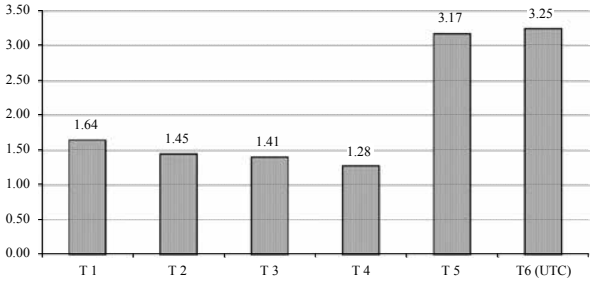

Figure 3. Severity before harvest

Sugarcane yield and quality

The yield ranges from 83.9 - 111.9 tons/ha. Among them, yield from Prevathon® 5 SC treatments was all higher than UTC with the highest at treatment 4 (111.9 tons/ha), followed by treatment 2 (106.6 tons/ha). The lowest was at treatment 5 (85.3 tons/ha), just slightly higher than UTC with 83.9 tons/ha (Table 3).

The CCS varies from treatments to treatments from 10.98 - 11.41 in which the highest ones belong to Prevathon® 5SC. These treatments also have better CCS than Furadan from 0.2 - 0.34 CCS (Table 3).

Table 3. Sugarcane yield and quality

Treatment	Yield (tons/ha)	(CCS)	Yield 10 CCS	
			Tons/ha	% increase over UTC
T1	99.4 b	11.34	112.69	22.26
T2	106.6 ab	11.41	121.63	31.96
T3	103.4 ab	11.27	116.57	26.47
T4	111.9 a	11.39	127.41	38.23
T5	85.3 c	11.07	94.46	2.48
T6 (UTC)	83.9 c	10.98	92.17	0.00
$LSD_{0.05}$	*9.16*	-	-	-
CV%	*5.12*	-	-	-

Gross margin

Total investment and total revenue on treated plots were higher than UTC. However, the gross margin was still better. The treatment 4 had the highest gross margin compared to UTC (25.914 mil VND/ha), followed by treatment 2 (21.372 mil VND/ha). The treatment 5 had lowest benefit, just over UTC 0.779 mil VND/ha.

CONCLUSION AND SUGGESTION

Conclusion

- Prevathon® 5 SC had control efficacy on sugarcane borers from application to harvest. The damage incidence and severity decreased the most significantly was on treatment 4 (drenching 1.5 kg Prevathon® 5 SC).

- Treatment 4 (drenching 1.5 kg Prevathon® 5 SC) gave to growers the highest gross margin, higher than Furadan 3G approximately 25,000,000 VND/ha.

- Prevathon® 5 SC had another good side benefits such as greener leaves and better crop vigor.

- Prevathon® 5SC was also very safe to natural enemies including both parasitoids and predators of sugarcane borers.

Suggestion

Further evaluattion on residue of both products Prevathon® 5SC and Furadan 3G in soil and post-processed sugar need to be carry out in order to have more appropriate recommendation to growers.

Table 4. Gross margin

Treatment	Total Invest (mil VND/ha)	Total revenue (mil VND/ha)	Gross margin vs. UTC (mil VND/ha)
T1	63.387	107.051	14.755
T2	65.268	115.549	21.372
T3	64.117	110.737	17.711
T4	66.215	121.038	25.914
T5	60.049	89.737	0.779
T6 (UTC)	58.649	87.558	0.000

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STUDY ON INSECT PESTS AND DEVELOPMENT OF THEIR CONTROL MEASURES ON DRAGON FRUIT

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Abstract

The study was conducted during the period of 2003 to 2012: (1) identify the damage caused by insect pests; and (2) set up IPM model for control of ants and fruit flies in the dragon fruit fields in three provinces (Tien Giang, Long An and Binh Thuan) in Southern Vietnam. Results showed that dragon fruit fields were most infected by ants and fruit flies. Evenly distributed on all surveyed areas, 7 species of ant and 3 species of fruit fly infested dragon fruit were identified. SOFRI trukien® and SOFRI protein® applications, field sanitary practices, traps reduced fruit fly population but no single method was able to guarantee sustainable control of ants and fruit flies. SOFRI protein® (hydrolyzed protein yeast waste mixed with fipronil 5SC 3 ml) was effective to control fruit flies when spot-sprayed onto the tree. On IPM dragon fruit orchards, the number fruit flies trapped by methyl eugenol was very low (15 flies per day) plus spray SOFRI protein were effective to control fruit flies, and the fruit yields of these orchards were clearly higher compared to famer orchards.

Keywords: Ants, fruit flies, dragon fruit, SOFRI Tru Kien®, SOFRI Protein 10 DD®

INTRODUCTION

Ants and fruit flies are of significant economic concern in the fruit tree industry in tropical countries (White and Elson-Harris, 1992; Nguyen Thi Thu Cuc, 2000). Some of them attack a wide range of fruits (White and Elson-Harris, 1992; Nguyen Van Nam, 2005). They display high reproductive rates, and great dispersal capacity (Nguyen Thi Thu Cuc, 2000), thus making the problem more difficult to tackle. Currently, their control management heavily depends on insecticides (Stonehouse *et al.*, 1998; Nguyen Huu Huan, 2005). The most common insecticides against ants and fruit flies are belonging to the groups of organophosphates, pyrethroids and carbamates (Besser and Gutmann, 1994; Nguyen Huu Huan, 2005). They normally provide a high and consistent level of protection (Allwood, 1997), but it is necessary to develop alternative control strategies which are equally effective and friendly to the agro-ecosystems.

Dragon fruit (*Hylocerus undatus*) is the most important fruit in the South of Vietnam in terms of value and amount of production, representing a major source of income in many farming households. However, the presence of ants and fruit flies and other serious pests has caused severe damage to the local production and created a barrier to Vietnam's access to world markets. In the southern provinces of Vietnam, 30 fruit fly and 7 ant species have been recorded and they infest numerous kinds of fruit and agricultural produce such citrus, longan, lychee, mango, plum, apple, dragon fruit and cucurbit vegetables (Drew *et al.,* 2001; Le Quoc Dien and Nguyen Thi Thu Cuc, 2007). Among the six fruit fly species of economic importance that are present in Vietnam, two species, namely the Oriental fruit fly *Bactrocera dorsalis* and the Guava fruit fly *Bactrocera correcta*, are considered to be associated with dragon fruit as their fruit host (Drew *et al.,* 2001). Up to now, there has been no complete effective control measure and farmers usually have to harvest fruits at an early date to minimize the yield and quality loss (Drew *et al.,* 2001). For many years, fruit growers in Vietnam have depended heavily on a broad-spectrum of insecticides (Le Quoc Dien and Nguyen Thi Thu Cuc, 2007). Integrated Pest Management (IPM) combines the

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