Diamide Resistance Updates – Contributing Factors and Some Learnings from the Philippines

IRAC Philippines Diamide Working Group

Sixth International Workshop on Management of the Diamondback Moth and Other Crucifer Insect Pests

Kasetsart University, Thailand
March 23, 2011

IRAC Philippines Diamide Working Group

- **Formed in 2009**
- **Presently, under the umbrella of CropLife Philippines Product Stewardship Committee**
- **Closely coordinating with IRAC International and IRAC SEA on resistance management programs**

IRAC Philippines Diamide WG Members

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Intensive Commercial Production Areas of Cabbage

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Registered and Commonly Used Insecticides in Vegetables

Chemical Sub-group	Active ingredient	Mode of Action	Main Group
Organophosphates	Profenophos, Malathion	AChE inhibitors	1
Pyrethroids	Deltamethrin, Cypermethrin, Fenvalerate	Sodium Channel modulators	3
Avermectins	Abamectin	Chloride Channel Activators	6
Indoxacarb	Indoxacarb	Sodium Channel blockers	22
Diamides	Flubendiamide, chlorantraniliprole	Ryanodine receptors modulators	28
Spinosyns	Spinosad	nAChr allosteric activators	5
Diafenthiuron	Diafenthiuron	Mitochondrial ATP synthase inhibitors	12
Nereistoxin analogues	Cartap	nAChr channel blockers	14

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DIAMIDES – What are they?

DIAMIDES

- *Main Group and Primary Site of Action –*
  - **Ryanodine Receptor Modulator**
- *Active Ingredients*
  - **Chlorantraniliprole**
  - **Flubendiamide**

IRAC MOA Classification

Current Diamide Registrations in the Philippines

Chemical subgroup: Diamides

Flubendiamide and Chlorantraniliprole were registered in 2006 and 2007 respectively

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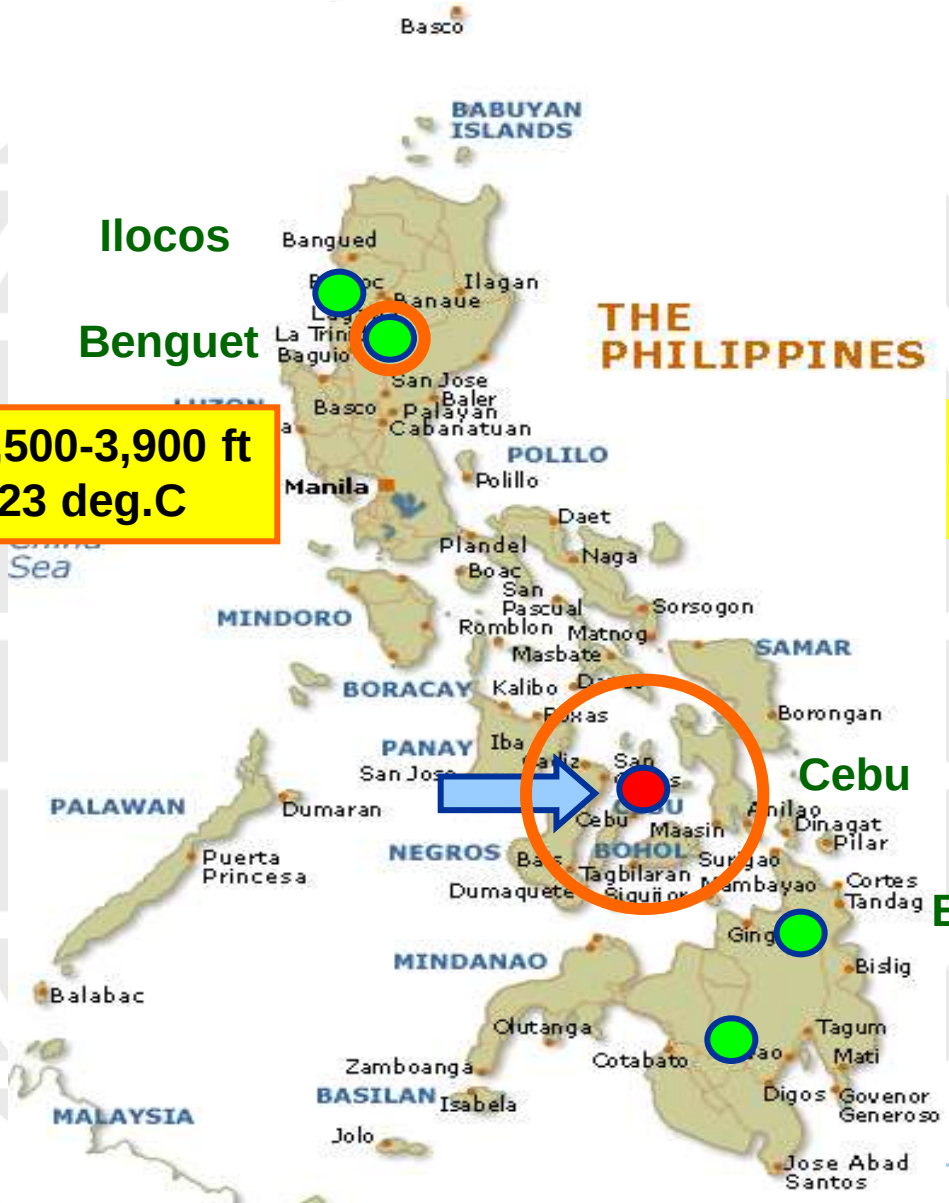
Crop: Cabbage
Report: Reduced efficacy against DBM in Cebu (September 2010)

Intensive Commercial Production Areas of Cabbage



Elevation: 1,500-3,900 ft
Temp.: 18.5-23 deg.C

Cabbage is planted throughout the year

Elevation: 100-2845 ft
Temp.: 25-28 deg.C

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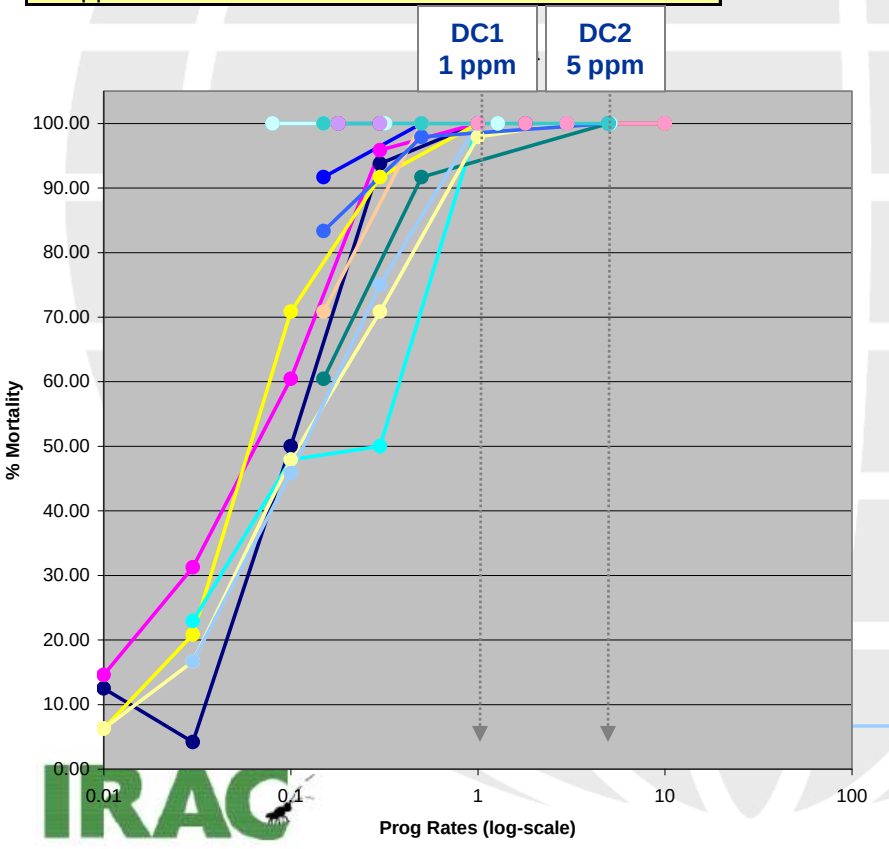
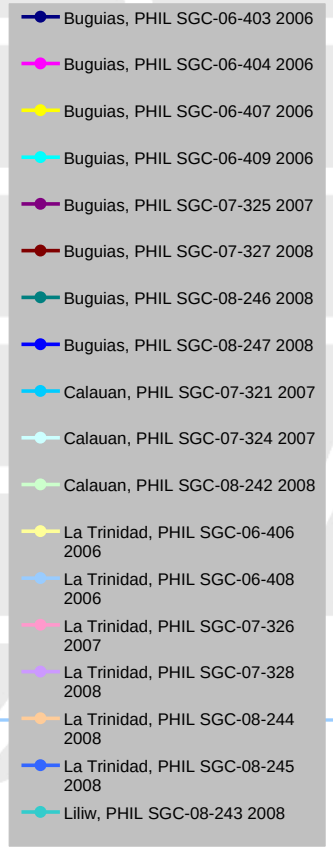
DuPont in-house Program

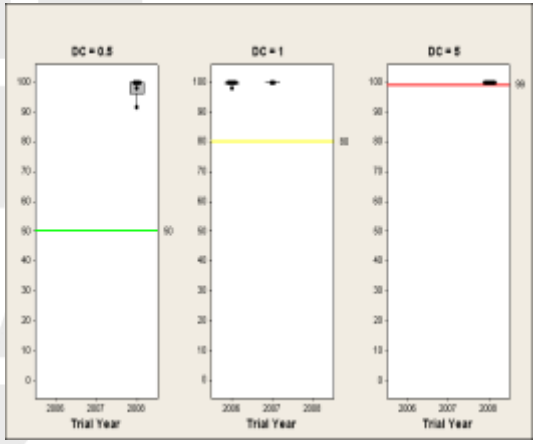
Chlorantraniliprole Reference Baseline (2006-2007-2008)

Highly susceptible FIELD populations from Calauan, field La Trinidad, and field Liliw

		Trial Year		
Country	Location	2006	2007	2008
Philippines	Buguias, PHIL	4	1	3
	Calauan, PHIL		2	1
	La Trinidad, PHIL	2	1	3
	Liliw, PHIL			1
Trial Year Total		6	4	8
Philippines Total				18







Proposed DC Rates:

DC1 = 1 ppm (LC_{95})

DC2 = 5 ppm (5x LC_{95})

Susceptible Populations:
Those with susceptibility level similar to that of susceptible field populations ➔ ≥ 95% mortality @ **1 ppm**

1 ppm = LC95 of susceptible field populations

5 ppm = 5x LC95 of susceptible field populations

- Significant survivorship (i.e. 20%) at this rate is indicative of incipient problems and greater risk of resistance developing quickly.
- Requires more intense education and IRM implementation at the field level.

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Philippines – *Plutella xylostella*

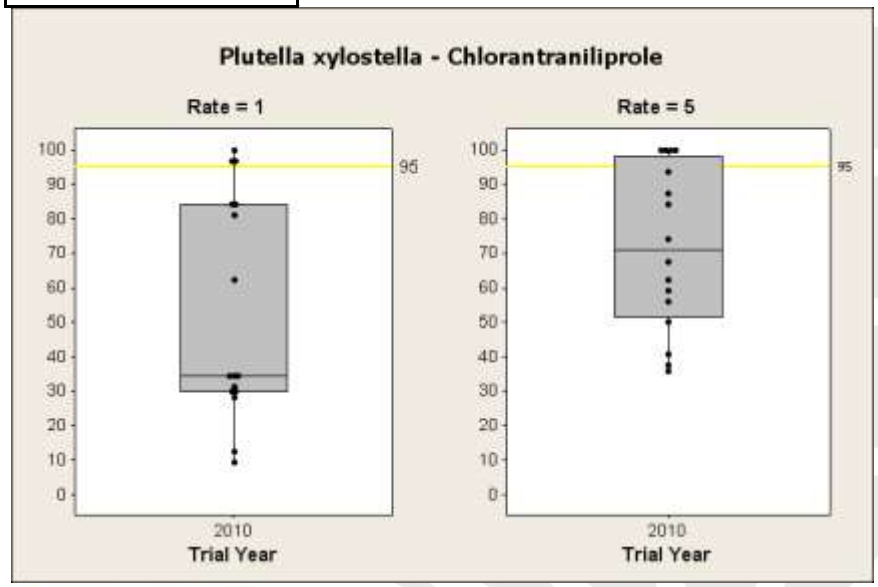
(IRAC Bioassay Method No. 018):

Overall Summary of Results from 2010 QI Field Monitoring Survey

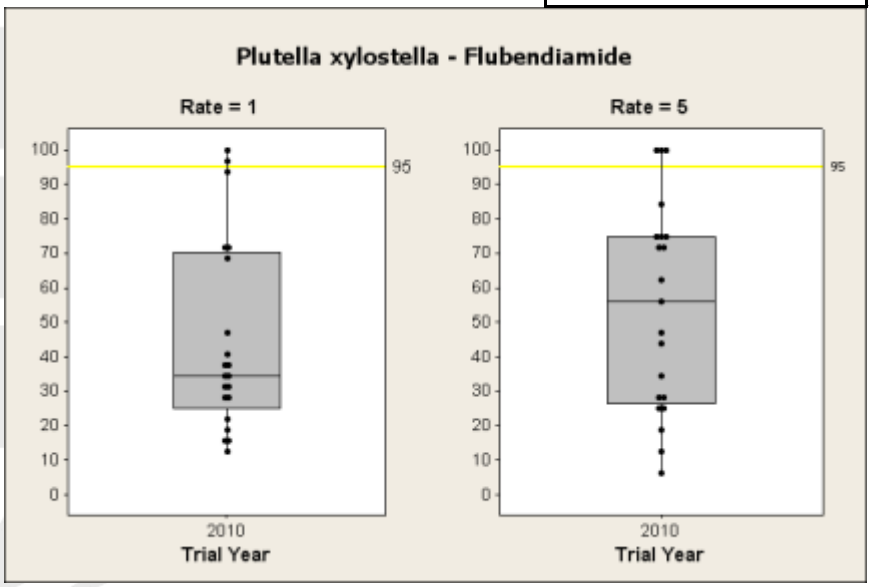
Proposed DC Rates (based on data from Susceptible Populations**:**

DC1 = 1 ppm (susceptible strain LC_{95})
DC2 = 5 ppm (5x LC_{95})

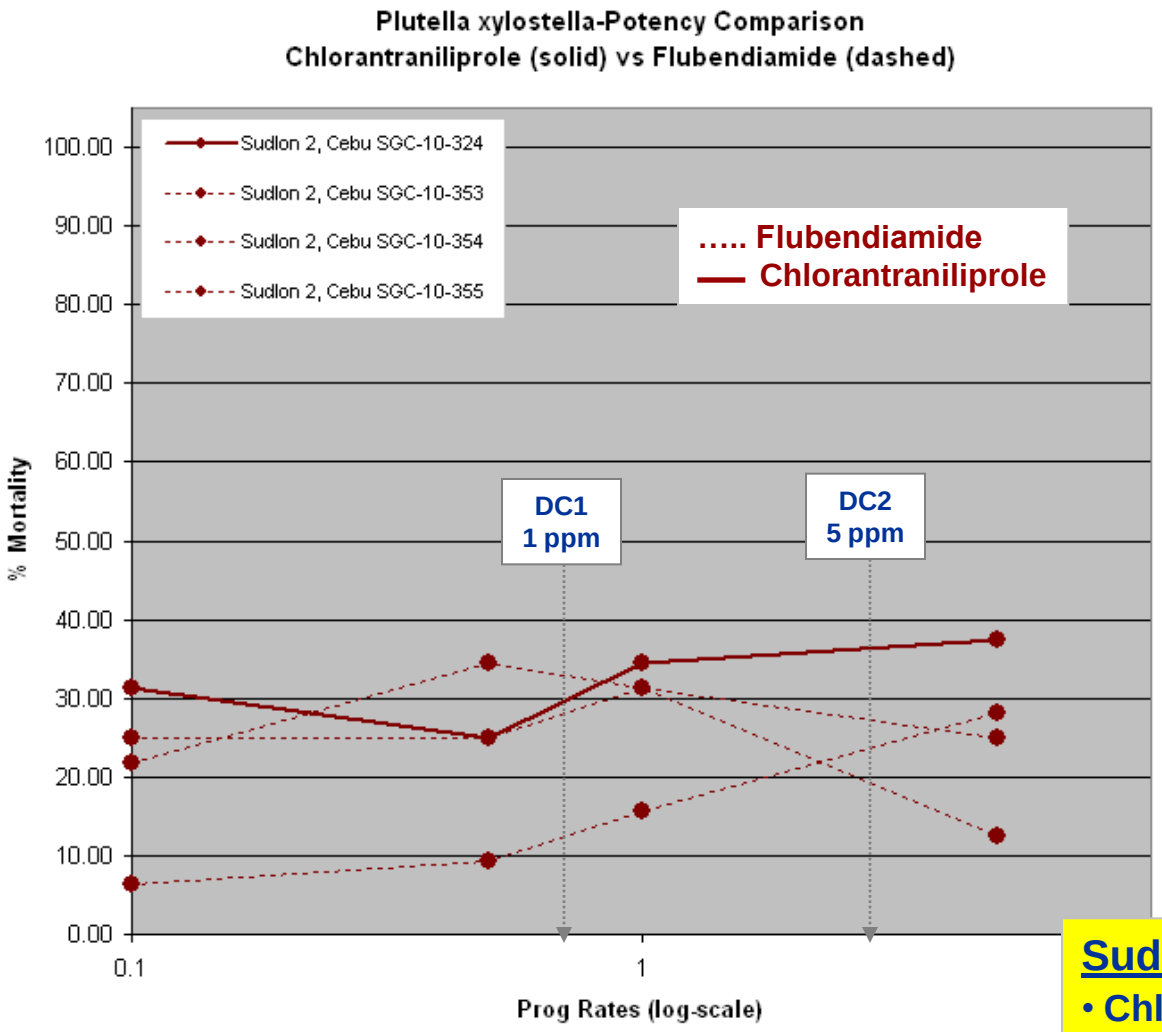
Counts of data points		2010
Rate2 =	1	16
Rate3 =	5	16



Counts of data points		2010
Rate2 =	1	21
Rate3 =	5	21



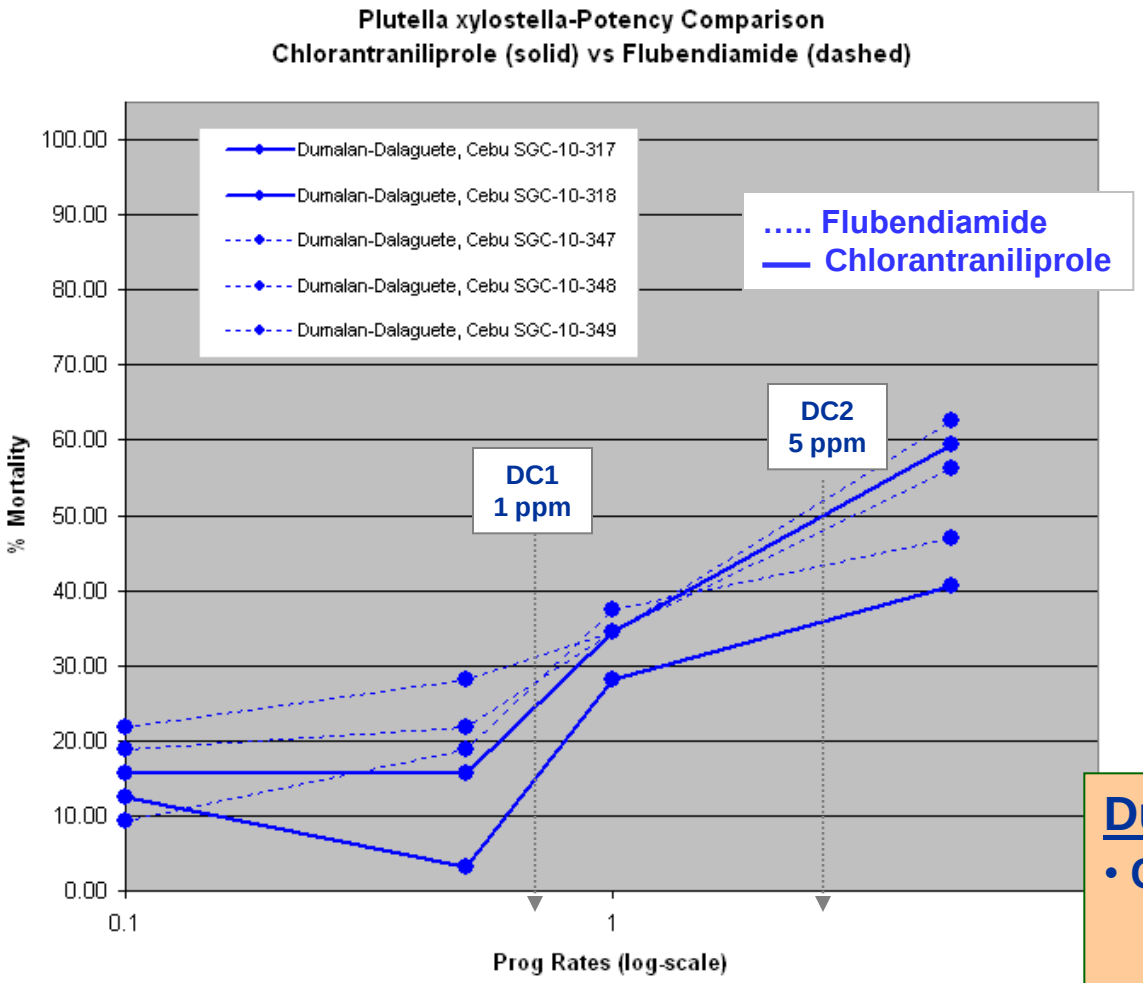
Field Location: Sudlon2, Cebu (2010)



Sudlon2, Cebu:

- **Chlorantraniliprole:**
  - 1 ppm: 34% mortality (1 rep only)
  - 5 ppm: 38% mortality (1 rep only)
- **Flubendiamide:**
  - 1 ppm: 16-31% mortality
  - 5 ppm: 13-28% mortality

Field Location: Dumalan-Dalaguete, Cebu (2010)



Dumalan-Dalaguete, Cebu:

- **Chlorantraniliprole:**
  - 1 ppm: 28-34% mortality
  - 5 ppm: 41-59% mortality
- **Flubendiamide:**
  - 1 ppm: 34-38% mortality
  - 5 ppm: 47-63% mortality

Background

- Responding to the report of lower sensitivity of DBM in Cebu to Diamide insecticides, the IRM-Diamide WG Philippines team launched a quick farmers' survey to learn about possible influencing factors
- Data was gathered from 100 cabbage growers in Cebu on August 20-24, 2010

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Profile of Representative Cabbage Growers in the Cebu, Philippines

Usage of Diamide Insecticides

- Among the 100 cabbage farmers interviewed:
  - ✓ More than half (54%) claimed to have experience using both Flubendiamide and Chlorantraniliprole
  - ✓ 19 farmers confirmed using only Flubendiamide as their diamide brand, 26 claimed using Chlorantraniliprole exclusively
  - ✓ 10 farmers mentioned using Chlorantraniliprole + Thiamethoxam

Incidence of use

- ➢ Use of diamide compounds among cabbage growers is very pronounced
- ➢ Flubendiamides and Chlorantraniliprole are the more popular compounds being used
- ➢ Use of multiple (at least 2) diamide brands may suggest rotation only within the diamide family

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Usage of Diamide

- Amongst the 100 cabbage farmers interviewed:
  - ✓ Insecticide applications for cabbage per season reaches a maximum of 12 sprays per season
  - ✓ Out of these 12 sprays, 63% are of Flubendiamides; while 55% are of Chlorantraniliprole

Frequency of spray

- ➢ Share of Flubendiamide slightly ahead over Chlorantraniliprole, in terms of % share of sprays

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Evaluation of Flubendiamide

- Among those who have used Flubendiamide:
  - ✓ Average dose rate per spray is at 6.45ml
  - ✓ Majority (61%) found the efficacy and control of Flubendiamide at around 50 to 80 percent; while 16% rated Flubendiamide at 80 to 100 percent control
  - ✓ Majority (at 52%) still placed Flubendiamides residual effect at 4-7 days, while 41% of users claimed residual effect of 7-14 days

Dosing

- ➢ Average dose rate slightly exceeds the recommended dose (3-5ml)
- ➢ Those who rated Flubendiamides at around 50-80 percent efficacy were found to be overdosing more, at 7.38ml

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Evaluation of Chlorantraniliprole

- Amongst those who have used Chlorantraniliprole:
  - ✓ Average dose rate per spray is at 17.57ml
  - ✓ Around 33% of farmers who have used the brand rated the efficacy at 80-100 percent ; 40% meanwhile said efficacy is only at 50- 80 percent.
  - ✓ Same with Flubendiamide, a big majority of Chlorantraniliprole users (at 73%) placed the residual effect at 4-7 days. Higher residual effect (7-14 days) for Chlorantraniliprole was at 23%.

Dosing

- ✓ Overdosing also being practiced for Chlorantraniliprole (15 ml), especially by those who rated the efficacy at 80-100 percent (19.30 ml)

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Rotation

- Very few practice rotation with other compounds
  - ✓ Very few practice diamide rotation with compounds from other chemical classes/modes of action
  - ✓ Their habit tells us that brand rotation is more pronounced than compound/mode of action rotation
- Likewise, incidence of tank-mixing with other insecticide compounds, with different modes of action, is very low
- In some cases there was mention of fungicides as well as insecticides in the tank-mix

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Summary of Survey Findings

Incidence of use	High incidence of diamide use
Frequency of spray	12 sprays in a season; around 70% or higher uses diamide products
Rotation	Rotation with compounds from other chemical classes/modes of action is generally not practiced
Dosing	Observed overdosing

Based on survey of 100 farmers in Sudlon Cebu

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Recommendation

- **A more comprehensive study program needs to be carried out in order to arrive at more conclusive results and sound recommendations for the use of Diamide insecticides in conjunction with crop protection products from other modes of action as well as other insect resistance management strategies**

Other things to be considered

Other things for consideration…

- Diamides were first introduced in the highlands of Northern Philippines (Benguet area) and have been successfully used since 2006.
- Monitoring programs have shown that susceptibility levels in the area is still higher compared to the hotspots of Central Philippines (Cebu in the Visayas).
- The DBM is an excellent adaptor and survivor allowing them to proliferate under different situations that will favor their reproduction.

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Other things for consideration…

- Companies have approached resistance management as individual entities not as a coordinated group.
- Even if there are programs, these are not sustained long enough and wide enough to really make a considerable impact.
- Other crops/plants that serve alternate host continuously exist in the farm.
- Products available for use in the market will not be used by the farmers unless there is active promotion of programs for resistance management.

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Other things for consideration…

- The industry cannot do it alone….
- **THERE IS A NEED FOR ALL STAKEHOLDERS TO WORK TOGETHER FOR OUR GOOD INTENTIONS TO WORK**

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Sustainable production of good quality and high yielding vegetables

Acknowledgement

Our working group would like to acknowledge IRAC International and IRAC SEA in supporting our efforts in promoting insect resistance management in vegetables

THANK YOU FOR YOUR ATTENTION

Maraming Salamat Po