Insecticide Resistance Action Committee

Country Diamide Working Groups

Expectations, Responsibilities, Process

Industry Response to Maintaining Susceptibility to Diamide Chemistry
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OBJECTIVE:
Development of IRM strategies for Group 28 insecticides (Ryanodine Receptor Modulators) to proactively maintain insect susceptibility and delay the evolution of resistance.

- 2008 August: IRAC Response to Intensity of Use
  - New global committee formed prior to major registrations of a new MOA class

- 2008 September: Global Action
  - Published Global IRM Guidelines for Diamides several “high risk” species
  - Identified high risk situations and emerging pest issues

- 2009 January: Country Action
  - Initiated country Diamide working groups - develop local IRM guidelines
  - Engage industrial and technical communities – Align IRM
# Country Diamide Working Groups (CDWG’s)

Country Diamide Working Groups (CDWG’s) are being established globally and will be industry’s main advocates to maintain diamide susceptibility.

17 CDWG’s exist as of Feb 2011 (Italy, Morocco, Turkey in progress)

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<thead>
<tr>
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### Brazil

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* Note. Group not yet formed (need to appoint Chair vs. members)

### India*

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* Note. Group’s first meeting will be March 5th (need to appoint Chair vs. members)

### Indonesia

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* Note. Group not yet formed (need to appoint Chair vs. members)

### Malaysia*

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* Note. Leadership of the team will be rotated every semestre (2nd semestre 2009: A. Toledo; 1st semestre 2010: J. R. Munhoz; 2nd semestre 2010: M. Flores; then starting again with A. Toledo)

### Philippines

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<tr>
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### Thailand

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<td>S. Sukonthabhirom</td>
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* Note. DDA (Department of Agriculture)

### USA

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### Vietnam

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**Guidance for Diamide Country Groups, August 2010**
Factors That Affect Evolution of Diamide Resistance

- **Target Organism:**
  - Several “high risk” species
  - Genetic variability

- **Product:**
  - Insecticidal activity and length (residual) of control

- **Intensity of Use:**
  - Over-dependency on single MOA
  - Number of applications per crop cycle and per year
  - Use rate per application, spray interval
  - Four companies offering two actives with same MOA

*We have no control over these conditions*

*Here is where we have the only opportunity to prevent or delay the evolution of resistance!!*

Maintaining Insect Susceptibility is an Industry Priority
Global formulations that contain Diamide chemistry are increasing and not obvious to growers

- Multiple Diamide products are often labeled for the same crop
- Growers are unable to determine that the active ingredients chlorantraniliprole, flubendiamide and all the various formulations contain the same MOA

- DuPont - 5 formulations of Chlorantraniliprole
- Syngenta - 2 formulations Chlorantraniliprole + 6 formulated mixtures
- Nihon Nohyaku - Flubendiamide + 2 premix products
- Bayer CropScience - Flubendiamide + 2 premix products

In total 20+ different trade names with products containing Diamides and potentially 2+ new Diamide actives in 2012 – 2020.

*Rynaxypyr® is the registered Trade name for the technical material chlorantraniliprole
Recommended Guidelines for Starting and Maintaining Country Diamide Working Groups
**Objective:** Maintain insect susceptibility and delay the evolution of resistance to diamides.

**Who:** Country experts from manufacturers and distributors of Diamide products and from the local technical community.

**Responsibility:** Develop, implement, and communicate Diamide IRM guidelines to customers and influencers.

- IRM Guidelines are developed by the Country Diamide WG working with local industry influencers. They are typically adapted from the Global Diamide IRM Guidelines.

- The focus is to implement IRM strategies before resistance occurs. Ideally just at launch or soon after.
Country participants will be contacted by the Global Diamide WG.

The first meeting will be initiated by a representative from one of the manufacturing companies.

Choose a leader who will coordinate meetings and agenda, be accountable for documenting meeting minutes and action items, and who will communicate with the Global Diamide WG.

A member of the Global Diamide WG will help initiate the first meeting and agenda. This person will also continue to advise the country Diamide WG as they progress.

It is highly recommended that country WG teams include company R&D personnel. Additional Marketing/Sales/ Business personnel are advisable but not mandatory.

The addition of key industry experts is recommended once the WG team has met a few times, understands their roles, and begins work on the IRM guidelines.

Team leadership can be alternated over time.
The Code is designed as a point of reference to establish standards of Conduct when IRAC Committees or individual IRAC Members are representing IRAC. This, along with the IRAC Antitrust Guidelines, forms the basis by which all IRAC Committees should operate.

The Code is also intended to reassure individuals and groups that interact with IRAC that the sole objective of the Committee is to counter the development of insecticide or acaricide resistance through joint technical strategies.

**DO:**
- Have an agenda and adhere to prepared agendas for all meetings.
- Take minutes and object if they do not accurately reflect the discussion.
- Consult legal counsel on all antitrust questions relating to meetings.
- Protest against any discussions or meeting activities which appear to violate the antitrust laws and leave any meeting in which they continue.

**DON’T**
- ...in fact or appearance, in meetings or other forum, formally, informally or even in jest, discuss or exchange information regarding:
  - Pricing policies/changes, credit terms, production, capacity, inventories
  - Changes in industry production, capacity or inventories.
  - Bids on contracts
  - Distribution or marketing plans of particular products
  - Matters relating to actual or potential individual customers or suppliers

* See full details in slides 21-26
1. Communicate the IRAC MOA Category (Group 28) to customers agencies.

2. Avoid repeated and exclusive use of Group 28 insecticides throughout a crop cycle for a pest species with more than one generation.

3. Use “Treatment Windows” of ca. 30 days and rotate with different Insecticide Mode of Action (MOA) groups to avoid exposure of consecutive pest generations to the same MOA.

4. For short cycle crops (< 50 days), consider the duration of the crop cycle as a “Group 28 insecticide treatment window”, thus alternate to different modes of action during subsequent plantings at the same farm location.

5. Do not expose more than 50% of the crop cycle to the same MOA group.

* See full details in slides 27 to 40

Global Diamide IRM Guidelines (view in presentation mode)
Step V:
Select Target Crops & Insects

- Review crops and insects on the Diamide labels
- Identify the insects that pose the highest risk for resistance development
  - Based on historical evidence
  - Based on potentially greatest exposure to Diamide chemistry
- For high risk pests, determine the potential total number of Diamide applications based on review of directions of use on the available labels
- Based on the above criteria, prioritize the species and the crops that require greater effort and focus activities of the Diamide working group on these species and crops
Step VI: Plan to Communicate Diamide MOA/IRM Guidelines & Add to Labels

All company representatives agree on the IRM Icon and language and develop a plan and timeline to add these to the company labels and to incorporate these guidelines into communications to users and influencers.

**Example 1: Comprehensive Version – Preferred**

**Insecticide Resistance Management (IRM)**

**General Recommendations:** Repeated and exclusive use of ___ (product name) or other Group 28 insecticides may lead to the development of insect resistant populations in some crops. Maintaining the longevity of ___ (product name) as an effective pest control tool for growers is critical, thus an insecticide resistance management (IRM) strategy should be established in the area of use (product name) should wherever possible be incorporated into an Integrated Pest Management program that includes cultural and biological control practices in association with the IRM guidelines detailed below. Consult your local agricultural authorities or company representative for more details.

Unless directed otherwise in the specific crop/insect sections of the label, the following practices are recommended to prevent or delay the development of insecticide resistance to ___ (product name):

- Apply ___ (product name) or other Group 28 insecticides using a “window” approach to avoid exposure of consecutive insect pest generations to the same mode of action. Multiple successive applications of ___ (product name) are acceptable if they are used to treat a single insect generation.
- Following a “window” of ___ (product name) or other Group 28 insecticide, rotate to a “window” of applications of effective insecticides with a different mode of action.
- The total exposure period of all “Group 28-active windows” applied throughout the crop cycle (from seeding to harvest) should not exceed 50% of the crop cycle.
- Avoid using less than labeled rates when applied alone or in tank mixtures.
- Target most susceptible insect life stages, whenever possible.
- Monitor insect populations for product effectiveness. If poor performance cannot be attributed to improper application or extreme weather conditions, a resistant strain of insect may be present. In this situation, ___ (product name) or other products with a similar mode of action may not provide adequate control. If insect resistance is a reasonable possibility, immediately consult with your local company representative or agricultural advisor for the best alternative method of control.

For additional information on insect resistance, modes of action and monitoring visit the Insecticide Resistance Action Committee (IRAC) on the web at [http://www.irac-online.org](http://www.irac-online.org).

**Example 1**

**Insecticide A® 50 SC**

**Active Ingredient:** [Compound name]

**Formulation details**

**Group 28 Insecticide**

**IRM Statement for Label**

**MOA Icon and wording for Label**
• Diamide company representatives agree on the IRM rotation scheme & guidelines for their priority markets.

• Visually illustrate these recommendations using crop and insect phenology charts.

• Demonstrate the concepts of “not treating successive generations” and the “Treatment Window” concept.

Example: Insecticide Mode of Action (MoA) “Window” Approach – 150 day cropping cycle

<table>
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<tr>
<th></th>
<th>0-30 days</th>
<th>30-60 days</th>
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Sequence of Mode of Action (MoA) Windows throughout the season
Step VIII: Plan to Educate Growers & the Ag Community

1. Develop Training Materials for Knowledge Transfer:
   - Power Point file (company logos signature)
   - Publish inter-company IRM Guidelines (brochures, Extension communications)
   - Company labels

2. Train, Gain Alignment, Recruit Implementers:
   - Company sales reps and other personnel
   - Government and University experts
   - Regulators, advisors, consultants, technicians
   - Distribution channel
   - Growers

3. Take Advantage of:
   - Grower and distribution channel meetings
   - Industry trade shows
   - Crop Protection and Entomology Meetings
   - Technical meetings and symposiums

Ensure Influencers include the IRM recommendations into their communications.
### Group 28 Diamide Products: Action Plan To Address Insect Resistance:
Guideline for High Risk Insect Pests in Targeted Markets

#### INITIAL STEPS: (PRE-LAUNCH AND EARLY POST-LAUNCH)

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<th>PROCESS – PROCEDURES - ACTIONS</th>
<th>RESPONSIBILITY</th>
</tr>
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</table>
| 1. Establish standard diamide insecticide bioassays to test targeted insects  
2. Develop baseline data on feral populations in targeted markets with diamide products  
3. Establish “Diagnostic Doses” for diamide products and targeted insect pests. | 1. Company, GDWG, IRAC Int'l  
2. Company (option-with GDWG)  
3. Company (option-with GDWG) |

#### IDENTIFICATION, CONFIRMATION, AND COMMUNICATION OF SUSCEPTIBILITY SHIFT IN INSECT PEST POPULATION

| 4. Conduct susceptibility testing in targeted markets- monitoring for lower than expected mortality at diagnostic doses:  
4.1 proactive monitoring program  
4.2 testing in reaction to field performance issue | 4. Company or Local DWG or Contractor |
| 5. Determine reduced susceptibility in insect population:  
5.1. replicate diagnostic dose bioassay (comparison with baseline)  
5.2 conduct full dose-response bioassay (comparison with baseline) - optional  
5.3 determine LC50 for susceptible population (calculate RR) - optional  
5.4 assess extent of susceptibility by regional monitoring (ID field failures, grower practices) | 5. Company or Local DWG or contractor |

If reduced susceptibility is confirmed by testing above:

| 6.1 GDWG develops a message, approved by the affected company, that explains the status of confirmed insect resistance and communicates it to all appropriate entities.  
6.2 check for cross-resistance to other Group 28 products (including selected other products)  
6.3 identify resistance mechanisms | 6.1 Affected Company + GDWG  
6.2 Company option  
6.3 Company option |

#### MITIGATION ACTIONS

| 7. Country Diamide WG (if established) develops a case-adjusted IRM mitigation plan in conjunction with Global Diamide WG and local technical experts  
8. Local Diamide WG aggressively implements the mitigation plan (training, monitoring, adjusts use recommendations) with assistance from academic and industry influencers  
9. Further restrictions of product use  
10. Continue susceptibility monitoring | 7. Country and Global Diamide WG’s and local influencers  
8. GDWG, local DWG, influencers  
9. Manufacturer option  
10. Company, Local DWG or Contractor |

Local Diamide WG involvement
Diamide manufacturers and distributors:

- ...are responsible stewards of their products and strongly promote discriminate use of insecticides.
- ...are committed to work with regulatory agencies, Ag ministries, University and Extension services, growers, and the Ag Industry to protect the environment. Delaying or preventing resistance by implementing IRM strategies promotes use of the labeled product rate which optimizes the amount of insecticides applied, reduces environmental loading, and helps conserve diversity of non-target organisms. Historically, grower response to increasing insect tolerance is to significantly increase use rates.
- ....lead the industry in developing and implementing resistance prevention activities to ensure the longevity and diversity of pest control technologies available to solve grower’s pest problems.
The Code is designed as a point of reference to establish standards of Conduct when IRAC Committees or individual IRAC Members are representing IRAC. This, along with the IRAC Antitrust Guidelines, forms the basis by which all IRAC Committees should operate.

The Code is also intended to reassure individuals and groups that interact with IRAC that the sole objective of the Committee is to counter the development of insecticide or acaricide resistance through joint technical strategies.

**DO:**
- Have an agenda and adhere to prepared agendas for all meetings.
- Take minutes and object if they do not accurately reflect the discussion.
- Consult legal counsel on all antitrust questions relating to meetings.
- Protest against any discussions or meeting activities which appear to violate the antitrust laws and leave any meeting in which they continue.

**DON’T**
- In fact or appearance, in meetings or other forum, formally, informally or even in jest, discuss or exchange information regarding:
  - Pricing policies/changes, credit terms, production, capacity, inventories
  - Changes in industry production, capacity or inventories.
  - Bids on contracts
  - Distribution or marketing plans of particular products
  - Matters relating to actual or potential individual customers or suppliers

* See full details in slides 21-26
Insecticide Resistance Action Committee

IRAC Code Of Conduct and Anti-Trust Guidance

For use by Country Diamide Working Groups developing IRM guidelines to optimize and maintain insect susceptibility when applying multiple insecticides with the same mode of action to the same crop

Excerpt from the IRAC Constitution
Issued, November 2009 Version 6.2

Approved by: IRAC Executive Committee

Further information is available at: www.irac-online.org enquiries@irac-online.org
The Objectives of the Code

The Code is designed as a point of reference to establish standards of Conduct when IRAC Committees or individual IRAC Members are representing IRAC. This, along with the IRAC Antitrust Guidelines, forms the basis by which all IRAC Committees should operate.

The Code is also intended to reassure individuals and groups that interact with IRAC that the sole objective of the Committees is to counter the development of insecticide or acaricide resistance through joint technical strategies.
1. Committees using the IRAC name and brand do so on the condition that they follow the IRAC Code of Conduct.

2. Committee meetings, discussions, minutes, recommendations and publications etc should relate solely to Committee administration and insecticide resistance matters. Companies and their representatives are free to follow their own commercial strategies against the background of recommendations given and accepted by IRAC; however it is important to maintain the integrity of the IRAC brand.

3. Resistance management is an essential part of product stewardship but misuse of resistance data or information can harm industry and IRAC’s long term interests.
   - Resistance statements must be scientifically and technically sound, verifiable and relevant.
   - There should be no misuse of research results or quotations from technical scientific or IRAC literature to discredit competitor products or promote proprietary products.
   - Any recommendation must be in line with agreed basic IRAC anti-resistance concepts

4. IRAC external communications should always include the IRAC name and preferably the IRAC branding rather than the individual’s personal, company or group affiliation.

5. IRAC external emails should ideally conclude with a “footer” making it clear that the correspondence is from IRAC and include the position, Committee or Team represented.

6. When providing contact address details for IRAC external communications ideally they should be given as “IRAC followed by Committee/Team Position and Care Of….,” followed by the individual’s personal, group or company address and telephone etc.

7. IRAC Committees or an agreed representative group of members should have the opportunity to view and comment on all IRAC external communications apart from those pertaining to routine administrative matters.

8. IRAC presentations, publications and posters etc should all include the IRAC branding and where possible exclude personal, group or company affiliations unless required to do.

9. IRAC presentations, publications and posters etc should be circulated in good time (ideally at least 7-14 days) to the appropriate local Committee to provide the opportunity for comment, prior to circulation or use in external forums.
● IRAC Committees and IRAC Members should be aware that while some activities among competitors are both legal and beneficial to the industry, group activities of competitors are inherently suspect under the antitrust laws. Agreements or combinations between or among competitors need not be formal to raise questions under antitrust laws, but may include any kind of understanding, formal or informal, secretive or public, under which each of the participants can reasonably expect that another will follow a particular course of action.

● All IRAC Members have a responsibility to see that topics, which may give an appearance of an agreement that would violate the antitrust laws, are not discussed during meetings, conference calls or in any other forum. It is the responsibility of each member in the first instance to avoid raising improper subjects for discussion and the purpose of the Antitrust Guidelines is to assure that participants are aware of this obligation.

● The Do’s and Don’ts presented below highlight only the most basic antitrust principles. Each participant should be thoroughly familiar with his/her responsibilities under the antitrust laws and should consult counsel in all cases involving specific situations, interpretations or advice.

Further information is available at: www.irac-online.org or enquiries@irac-online.org
Do not, in fact or appearance, in meetings or other forum, formally, informally or even in jest, discuss or exchange information regarding:

1. Individual company prices, price changes, price differentials, mark-ups, discounts, allowances, credit terms, etc., or data that bear on price, e.g. costs, production, capacity, inventories, sales, etc.

2. Industry pricing policies, price levels and price changes, differentials, etc.

3. Changes in industry production, capacity or inventories

4. Bids on contracts for particular products; procedures for responding to bid invitations.

5. Plans of individual companies concerning the design, production, distribution or marketing of particular products, including proposed territories or customers.

6. Matters relating to actual or potential individual customers or suppliers that might have the effect of excluding them from any market or of influencing the business conduct of firms toward such suppliers or customers.

Further information is available at: www.irac-online.org or enquiries@irac-online.org
1. Have an agenda and adhere to prepared agendas for all meetings.

2. Get minutes taken and object if they do not accurately reflect the discussion and actions taken.

3. Consult with legal counsel on all antitrust questions relating to meetings.

4. Protest against any discussions or meeting activities which appear to violate the antitrust laws and leave any meeting in which they continue.

Further information is available at: www.irac-online.org or enquiries@irac-online.org
Revisiting Step IV: Review Global Diamide IRM Guidelines
Guideline 1: Communicate IRAC MOA Category (Group 28) to Users

→ Labeling and Identification of Group 28 Insecticides:

- Growers need to recognize and understand which products they can rotate.
- Identification of the insecticide MOA should be on the label; either on the first page or in the IRM section and included in technical brochures.

Example 1

**Insecticide A® 50 SC**

Active Ingredient: [Compound name]

Formulation details

<table>
<thead>
<tr>
<th>Group</th>
<th>Insecticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

Example 2

**Insecticide A® 50 SC**  
**Insecticide B® 25 SC**

Active Ingredients: [Compound names]

Formulation details

<table>
<thead>
<tr>
<th>Group</th>
<th>Insecticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Insecticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>
Maintaining insect susceptibility greatly depends on rotation of Diamide insecticides with effective products with a different MOA that eliminate Diamide-resistant individuals. Rotation with products that provide poor control of the target pest increases the risk of developing Diamide resistance.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Gen</td>
<td>2nd Gen</td>
<td>1st Gen</td>
<td>2nd Gen</td>
</tr>
<tr>
<td>1st Gen</td>
<td>2nd Gen</td>
<td>1st Gen</td>
<td>2nd Gen</td>
</tr>
<tr>
<td>1st Gen</td>
<td>2nd Gen</td>
<td>1st Gen</td>
<td>2nd Gen</td>
</tr>
</tbody>
</table>

**No alternation/rotation**
- High selection pressure
- No recovery of sensitive population.

**Rotation within generation**
- Consecutive generations exposed to same MoA. Selection pressure doesn’t change between generations. Risk of resistance development for both ai’s.

**Rotation among generations**
- Following generations are not exposed to same MoA. Selection pressure doesn’t increase within the generation. Recovery of susceptible population.

**Rotation within and between**
- Ideal situation (very low risk) Not always applicable with good efficacy.

<table>
<thead>
<tr>
<th>MoA 1</th>
<th>MoA 2</th>
<th>MoA 3</th>
<th>MoA 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>21st Gen</td>
<td>2nd Gen</td>
<td>1st Gen</td>
<td>2nd Gen</td>
</tr>
</tbody>
</table>
Guideline 2: Avoiding Excessive Use of Diamides

Avoid exclusive use of Group 28 insecticides throughout a crop cycle for a pest species with more than one generation.

“DO NOT expose successive pest generations of the same species to the same insecticide mode of action”

Scheme below → NOT RECOMMENDED
Avoid exclusive use of Group 28 insecticides throughout a crop cycle for a pest species with more than one generation.

“DO NOT expose successive pest generations of the same species to the same insecticide mode of action”

Scheme below → NOT RECOMMENDED
Use “Treatment Windows” of approximately 30 days and rotate with different Insecticide Mode of Action (MOA) groups to avoid exposure of successive pest generations to the same MOA.

**Example:** Brassicae

![Diagram showing growth stages of Brassica plants and corresponding insecticide application and resistance management (IRM) strategies for Diamondback Moth and Leafworm.](image-url)
Use “Treatment Windows” of approximately 30 days and rotate with different Insecticide Mode of Action (MOA) groups to avoid exposure of successive pest generations to the same MOA (It is recommended to not spray the 3rd generation since then more than 50% of the crop would be exposed to diamides).
→ Use “Treatment Windows” of approximately 30 days and rotate with different Insecticide Mode of Action (MOA) groups to avoid exposure of successive pest generations to the same MOA.

Example: Rice

Guideline 3:
Use of “Treatment Windows”
If you spray 1st generation with IRAC 28 insecticide: Do not spray 2\textsuperscript{nd} or 3\textsuperscript{rd} generation! (It is recommended to not spray the 3rd generation since then more than 50% of the crop would be exposed to Diamide insecticides)

Example: Apples, 1\textsuperscript{st} Generation
If you spray 2\textsuperscript{nd} generation with IRAC 28 insecticide:
Do not spray 1\textsuperscript{st} or 3\textsuperscript{rd} generation

Example:
Apples, 2\textsuperscript{nd} Generation
If you spray 3rd generation with IRAC 28 insecticide: Do not spray the 1st generation of the following year.

Example:
Apples, 3rd Generation

Guideline 3: Use of “Treatment Windows”

Insecticide Resistance Action Committee
→ For short cycle crops (< 30-50 days), consider the duration of the crop cycle as a “treatment window”. Alternate to different modes of action during subsequent plantings at the same farm location.

Guideline 4:
For Short Cycle Crops, a “Treatment Window” is a Crop Cycle

For short cycle crops (< 30-50 days), consider the duration of the crop cycle as a “treatment window”. Alternate to different modes of action during subsequent plantings at the same farm location.
Example: Leafy Vegetables – Soil Application:
Use treatment windows (approx 30 day windows) and avoid exposure of > 50% of crop cycle.

Example: A Group 28 Soil Application: Rotation with Effective MOA Groups

- **Group 28**: 1 soil application only (drench, drip, seedling tray)
- **Active Window**: < 50% of Crop Cycle = 5-35 days
- **Non-Group 28 Insecticides with different MOA's**: Free Window (at least 50% of Crop Cycle = 35-60 days)
Guideline 5:
Do Not Expose > 50% of Crop Cycle to the Same MOA Group

Example: Leafy Vegetables – Foliar Application:
Use treatment windows (approx 30 day windows) and avoid exposure of > 50% of crop cycle.

Example: 2\textsuperscript{nd} foliar application with a Group 28 insecticide $\rightarrow$ Rotate with Effective MOA Groups

Guidance for Diamide Country Groups, August 2010
Example: Leafy Vegetables – Foliar Application:
Use treatment windows (approx 30 day windows) and avoid exposure of > 50% of crop cycle.

Example: 1st Foliar application with a Group 28 Insecticide → Rotate with Effective MOA Groups

Group 28
Active Window
< 50% of Crop Cycle = 12-42 days – Spray after transplanting

Non-Group 28
Free Window >42 days (at least 50% of the Crop Cycle)
Suggested Additions to Country IRM Communication
Maintaining Susceptibility of Diamide Insecticides: An Industry Responsibility

Insecticide Resistance Strategies

From The _______ Diamide Council

International IRAC does not want individual company names advertised. So ideally you need to remove this line and add the line below (IRAC and CropLife) and also add the next slide that shows all the companies in IRAC.
Please add this slide. This will give even greater impact on this communication since it states that all these companies support the Diamide IRM strategies and other products are required as rotation partners.
What Are Diamides???

Insecticides That Are “Diamides”

There are different products available in the market that represent two different, but related, chemical classes of insecticides based on their common chemistry. These products are generally referred to as “Diamides”.

<table>
<thead>
<tr>
<th>Product Trade Name</th>
<th>Insecticide Chemistry</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevathon®</td>
<td>Anthranilic Diamide</td>
<td>DuPont</td>
</tr>
<tr>
<td>Voliam Flexi®</td>
<td>Anthranilic Diamide/Neonicotinoid</td>
<td>Syngenta</td>
</tr>
<tr>
<td>Fenos®</td>
<td>Phthalic Diamide</td>
<td>Bayer</td>
</tr>
</tbody>
</table>

List the diamide products by trade name available in your country.

Based on their common chemistry these products are generally referred to as “Diamides”.
How Do Diamides Kill Insects – What is their Mode Of Action???

Diamide Insecticides (Fenos®, Prevathon®, Voliam Flexi®)
Disrupt Muscle Function in Insect Pests Causing Paralysis and Death

• The “Mode of Action” of Diamide insecticides is the disruption of the ryanodine receptors in muscle cells which stops muscle function.
• The Diamides stop calcium ion movement into the muscle, resulting in cell dysfunction and muscle paralysis of the target insect pest.
• Diamides are classified by the Insecticide Resistance Action Committee (IRAC) as Ryanodine Receptor Modulators in Group 28.

Good idea to add this slide that explains how diamide insecticides affect insects.
Benefits of Maintaining Insect Susceptibility to Diamides

1). Increased Product Longevity:
   - more effective products are available for a longer period.
   - growers have more pest control options; increased flexibility in product selection

2). Growers Save Money:
   - no need to increase dosage increased to maintain efficacy
   - no need to tank mix to control pests

3). More Stable Crop Production:
   - better assurance of good pest control
   - expect more consistent crop protection and stable yields

4). Protection of the Environment:
   - less active ingredient applied to ecosystem
   - more control over spray program and products used; not in survival mode