

## **Overview of an Insect Resistance Management (IRM) Plan for Plant Protection Insecticides\***

In order to preserve the maximum efficacy of plant protection insecticides over an extended period of time, growers need to utilize pest management strategies that are based on sound Insect Resistance Management (IRM) principles. Resistance management is dynamic and such strategies should be addressed at all levels within academia, extension, crop consultants, growers and the agricultural chemical industry. Implementation of IRM strategies and tactics will need to be customized to local conditions depending on the crop, pest(s) and insecticide use history. Because the registrants and manufacturers of crop protection products are best positioned to characterize their products' strengths and weaknesses, it is customary that the primary lead for developing the appropriate resistance management strategies and tactics are scientists and technical representatives from the agricultural chemical industry. The registrants and manufacturers have a clear understanding of their products and also stand to gain or lose the most from action or inaction. As such, IRM should be an integral part of product stewardship among registrants and manufacturers with appropriate consultation from crop experts in land grant universities or extension. Product stewardship involves collaboration between registrants and manufacturers via organizations such as CropLife America and the Insecticide Resistance Action Committee (IRAC-US) in order to develop sound and practical IRM plans that represent clear value to growers and consumers alike. It also involves creating product use directions, recommendations and restrictions on labels which maximize the net benefits of each product while also ensuring product efficacy, safety and minimal environmental impact, while maximizing the product lifespan.

### **Key goals for an IRM plan for plant protection insecticides may include:**

#### **Proactive Goals and Objectives**

- Via research and field development, understand the mode of action of a plant protection insecticide to determine its proper place and fit among existing groups of insecticides.
- Establish the baseline susceptibility of key high-resistance-risk pests (especially in regions which have a history of resistance issues) prior to and/or in the early years of commercialization. This may include:
  - Identification of a proper susceptible pest strain early in the product launch cycle for future comparisons.
  - Development of a workable diagnostic test to quickly determine resistance.
- Include mode of action group on product labels.

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- Provide resistance management recommendations on product labels.
- Encourage use of Integrated Pest Management (IPM) practices by growers.
- Develop educational literature for growers, researchers and extension agents to increase resistance management awareness, particularly at the grower level.
- Monitor product performance over a wide range of geographies and observe or track changes in the susceptibility of pest populations over time.
  - Train technical staff to identify and report any case of “field failure” and promptly assess the basis of non-performance.
  - Work with regional experts to address concerns.
  - If lower than expected performance cannot be attributed to improper label use or application techniques or unfavorable weather conditions, then surviving insects should be collected, reared, and tested for resistance.

## **Reactive Goals and Objectives**

- Investigate the mechanism(s) of resistance in field-relevant resistant populations.
- Investigate the genetic basis of such resistance.

## **Development of an IRM Program as a component of IPM**

Certain insect pests have a known propensity to develop resistance quickly, especially when insecticides with the same mode of action are used repeatedly. Because resistance development is not easy to predict (scale and location), the use of insecticides should be based on acceptable IRM plans that integrate local resistance management tactics already established for the specific crop and region. It is likely that IRM tactics will need to be customized, validated and tested again over time while integrating new products or new approaches. Many IRAC-US member companies collectively develop common IRM language on their product labels to encourage responsible product stewardship. This ensures that key insecticides forming the cornerstone of insect pest management remain effective for insect control. Often IRM plans involve the use of treatment windows during the crop cycle, along with natural biological control agents and alternate control methods (e.g., pheromones/male confusion, genetic breeding for crop resistance to pests). If resistance to a particular insecticide is suspected in a region (frequent reports of non-performance), related products with a similar mode of action also may not provide adequate control. If the poor performance cannot be attributed to improper label use or application techniques or unfavorable weather conditions, a resistant strain of insect could be the cause of field failure. Growers are encouraged to immediately contact the company’s local technical representative to better understand the cause of the field failure and initiate proper remedial measures through collaborative action. As a follow up,

some surviving insects are collected, reared and tested to confirm the presence/absence of resistance. Based on the outcome, the company personnel along with the regional extension agents or pest control advisors discuss the best alternative method of control for the region.

## **Key Use Recommendations for Insect Resistance Management:**

- Avoid repeated sequential use of insecticides (seed treatment, soil application and foliar application) with a single mode of action for season-long control of any target insect species that has more than one generation per crop per season. Rotate with an effective insecticide with a different mode of action.
- For insect species with multiple or overlapping generations, use a treatment window approach. A treatment window is a period of time in the crop cycle when the target pest is present at economically damaging levels and needs to be treated. Within this treatment window (such as soil applications, early, mid and late crop foliar applications), single or multiple applications can be made. Different modes of action are used in different treatment windows.
- Applications should target early insect developmental stages or most susceptible stages whenever possible.
- Integrate local IPM practices specific for the crop and use area for managing the pests of concern.
- Scouting to determine a management decision should be made prior to and following an application of an insecticide or miticide.
- Insecticide mixtures may offer benefits for IRM when appropriately incorporated into rotation strategies with additional mode(s) of action, but generally a single mixture should not be relied upon alone.
- When using an insecticide mixture (tank mixture or pre-mixture), the following aspects should be considered:
  - Individual insecticides selected for use in mixtures should be highly effective and be applied at the rates at which they are individually registered for use against the target species.
  - Mixtures with components having the same IRAC mode of action classification are not recommended for IRM.
  - When using mixtures, consider any known or potential cross-resistance issues between the individual components for the targeted pest/s.
  - Mixtures become less effective if resistance is already developing to one or both active ingredients, but they may still provide pest management benefits based on spectrum of the targeted insects.

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- The IRM benefits of an insecticide mixture are greatest if the two components have similar periods of residual insecticidal activity. Mixtures of insecticides with unequal periods of residual insecticide activity may offer an IRM benefit for the period where both insecticides are active.
- If field failures are common and resistance is a likely cause, immediately consult your local company representative or agricultural advisor for the best alternate method of control for your area and begin remedial measures. Report resolved problems to the representative.

## **Resources for Insect Resistance Management Information:**

- Contact your local extension specialist, certified crop advisor and/or product manufacturer for additional IRM recommendations.
- Visit the IRAC website at <http://www.irc-online.org/> for more information on Mode of Action classification and other relevant information on specific resistance management strategies.

**\* This document applies to plant protection insecticides and does not apply to insect-protected transgenic crops or public health products**