

TECH TRAINING: CHEMICAL ROTATIONS

Chemical pesticides are essential tools used to control the development and spread of pests and pathogens including insects, mites, fungi, and bacteria. Over time, the consistent use of similar chemicals can result in the target pest or pathogen developing resistance to that type of chemical, rendering them ineffective. Insecticides and fungicides are grouped based on chemical properties, and these groups should be rotated to prevent resistance and preserve these valuable tools.

Tip 1: Understand Chemical Options

- List preferred products and compare group numbers.
 - Chemicals from the same group should not be used consecutively.
 - Some active ingredients have multiple trade names.
- Watch for combination products!
 - May provide better control but limit rotation options.
- Be cognizant of geographical- and crop-based restrictions.
 - Consider species, growth stage and growing conditions.

GROUP 11 FUNGICIDE



Examples of FRAC and IRAC Group numbers.

Tip 2: Develop Rotation Programs

- Preventative applications can limit outbreaks.
 - Help maintain resistant varieties.
- Know the major crops, pests and pathogens.
 - These vary by location, time of year, weather conditions and crop assortment.
- Optimize curative applications.
 - Use appropriate products *based on pest life stage*.
 - Correctly identify pathogens to ensure fungicide efficacy.



Disease resistant varieties are more easily maintained with proper chemical rotation.

Tip 3: Use an Integrated Approach

- Utilize cultural, mechanical, environmental, and biological controls.
 - Maintain a culture of sanitation.
 - Consider biopesticides and beneficial insects and mites.
- Scout regularly to find pests and diseases before they get out of hand.
 - Rapidly identify and make targeted applications where necessary.



While spraying is an important aspect of pest and disease control, integrated pest management should also be implemented.

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Mode of Action. A pesticide's mode of action (MOA) refers to the way the chemical affects a specific pest or pathogen. Pesticides are assigned group numbers based on the MOA, so a rotation should include chemicals from several different group numbers. Repeatedly using pesticides from the same group leads to the development of resistant populations. A resistant pest or pathogen will no longer be controlled by the specific product it has gained resistance to, or other chemicals from the same group number. *To develop a true rotation, use chemicals from at least three different groups.*

Insecticide & Miticide Options. The [Insecticide Resistance Action Committee \(IRAC\)](#) develops insecticide and miticide group codes and has an online [Training Centre](#) to provide educational resources on rotation management. When building a rotation for a particular pest, include at least three different IRAC groups, but also consider important limitations a chemical may have. For instance, certain chemicals (like insect growth regulators) may only be effective against pests in a particular growth stage such as eggs, juveniles, or adults. Also consider the pesticide application method and residual activity, as these factors impact efficacy and the timeframe for the next application in the rotation. Chemicals may also be classified as having contact, translaminar or systemic activity, which refers to whether the active ingredient can move throughout the plant to reach the target pest.

Fungicide Options. The [Fungicide Resistance Action Committee \(FRAC\)](#) develops fungicide group codes and provides [lists, posters, and other resources](#) to simplify rotation management for professional growers. Understand what options are available to control common pathogens. An important consideration is that many commercial fungicides are combination products with active ingredients from multiple classes. For instance, several top fungicides on the market are combinations of groups 3 (DMI), 7 (SDHI), and 11 (QoI). These factors must be kept in mind when developing a rotation.

Use Available Resources. Many universities, trade publications, chemical manufacturers and distributors have freely available resources online to help growers develop rotation programs. One such publication is the [GrowerTalks Insecticide, Miticide & Fungicide Guide](#), which contains tables listing different chemical groups, active ingredients and commercial products, as well as chemical options for key pests. Michigan State University updates their documents on greenhouse [Pest](#) and [Disease](#) Management annually. *Greenhouse Management* also has a six part series on the topic of resistance management ([Part 1](#), [Part 2](#), [Part 3](#), [Part 4](#), [Part 5](#) and [Part 6](#)).

In Summary. Maintaining an appropriate pesticide rotation can maximize the efficacy of chemical inputs for the current growing season and years to come. Rotation is the best method to mitigate the risk of developing resistance in key pests and pathogens. Keep in mind that many chemical manufacturers and distributors have free resources with rotations already developed. Ensuring available pesticides remain effective is critical for the future of floriculture production.

For more information, check out these additional resources:

Tech On Demand Podcast: [Developing a Pesticide Rotation Program \(and more\) with JC Chong](#)

GrowerTalks: [Insecticide, Miticide, & Fungicide Guide](#)

GrowerTalks: [More Rotation, Less Frustration](#)