



Resistance Management

Why Does Resistance Management Happen and How Can You Manage It?

The development of pesticide resistance by pest populations can have significant consequences – none of which are desirable. As resistance develops in the population, a product must be used at increasingly higher rates and more frequently in order to achieve effective control. Eventually that product becomes ineffective and provides little or no pest control.

Resistance is a genetically based phenomenon that occurs when pest populations are repeatedly exposed to the same pesticide active ingredient. Depending on the mode of action of that pesticide and how often it is applied, resistance can develop rapidly, or over a long period of time. All pests have the potential to develop resistant populations – insects, mites, fungi, bacteria, weeds, nematodes – even rodents. Insects and mites have the highest likelihood of developing resistance to pesticides – in excess of 400 species have developed resistance to insecticides and acaricides.

There are tactics that every grower can utilize to help reduce the development of pesticide resistant populations. These tactics are part of a broad strategy we know as Integrated Pest Management – a combination of tools and techniques designed to control pests, reduce environmental impact, and diminish the likelihood of resistance.

Some Key Elements of Resistance Management

- Reducing the use of chemical pesticides
- Not tank mixing materials with similar modes of action
- Avoiding persistent chemical pesticides
- Using rotations of materials with different modes of action

Products Designed for Resistance Management

BioWorks provides growers with products that are ideal for use in resistance management programs. These products provide alternatives to chemical pesticides and can be used alone, in a tank mix, or in rotation as part of an integrated management program. In addition, many of BioWorks' products employ multiple modes of action – the chances of pests developing resistance to them are extremely low.

- BotaniGard® or Mycotrol® work very well as a tank mix partner or in a rotation to manage insect pests such as whitefly, thrips, and aphids
- RootShield® is an excellent preventative of root rot diseases and is compatible with many common soil fungicides
- MilStop® is an outstanding material for use in a resistance management program for powdery mildew and other foliar pathogens – it can be tank-mixed and used in rotation with conventional foliar fungicides
- CEASE® is a versatile product that can be used in a foliar or drench program for control of many fungal and bacterial pathogens
- SuffOil-X® is designed to complement and supplement pest control programs for foliar insects and mites
- Molt-X® acts primarily as an insect growth regulator that works especially well as a tank-mix or rotational partner with BotaniGard, Mycotrol or SuffOil-X



A well-designed resistance management strategy will help maintain the commercial life of pest control products and reduce environmental impacts associated with the misuse of chemicals. Resistance management should be a broad-based effort and include multiple tactics – chemical, biological, and cultural. However – your strategy must be developed in advance. Waiting until the population becomes resistant before establishing a resistance management program simply will not work.

Refer to product labels for complete application details. Additional technical information is available on our website (bioworksinc.com) or from your BioWorks technical sales representative. RootShield®, Molt-X®, SuffOil-X®, MilStop® and CEASE® are registered trademarks of BioWorks, Inc. BotaniGard® and Mycotrol® are registered trademarks of LAM International. Always read and follow label directions.