



BioWorks®
How You Grow Matters™



Resistance Management

Why does it happen and how do I manage it?

By Randy Martin, Ph.D., Dir. of Product Development, BioWorks

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 of the key elements of resistance management are:

1. reducing the use of chemical pesticides
2. not tank mixing materials with similar modes of action
3. avoiding persistent chemical pesticides
4. 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. Our 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.

Choose **BotaniGard®** 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 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.

To find out more about the BioWorks family of products, please contact us at **800-877-9443** or visit www.bioworksinc.com. © 2008 BioWorks, Inc.

RESPONSIBLE :: ECONOMICAL :: PROVEN