

GROWERTALKS

Features

7/30/2014

Plug & Cutting Conference: Effective Use of Biopesticides

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Seedlings and cuttings are particularly vulnerable to attack by pathogenic bacteria, fungi and oomycetes, which can cause substantial disease losses if not managed properly. Biological control strategies can be used as a first line of defense to effectively and affordably manage diseases of young plants before resorting to synthetic chemical treatments. Key to the success of both biopesticides and chemical fungicides is the use of good integrated disease management (IDM) practices, including thinking proactively (disease prevention rather than cure), maintaining effective crop sanitation, avoiding cultural practices that favor disease development and exploiting pathogen

weaknesses.

Pictured: Lily plants produced commercially in Pythium-infested potting mix (moderate disease pressure). Control plants on left were not treated with a fungicide, while plants on right were treated with a registered biopesticide at potting.

Since the 1990s, biopesticide use has gradually spread mostly eco-conscious to more conventional greenhouse and nursery growers. Continued losses of conventional products, the lack of new chemistries to replace them and the development of pesticide resistance have prompted many growers to consider using biopesticides in recent years. Also, some growers consider using biopesticides to promote the health and safety of their workers, consumers and the environment. Even large retailers have begun seeking “greener” plant material to sell in their garden centers.

Better technical resources, formulation improvements and expanded product offerings have brought about biopesticides that are more cost-effective, predictable and attractive to growers. Still, starting to use biopesticides in disease management programs seems risky to many growers. Chances of success with biopesticides are greatly affected by growers’ basic knowledge and understanding about what they offer, how they work, what limits them and how they should be handled and used. The goal of this article is to provide readers with basic information about biopesticides and points to consider when trying to incorporate them for

best success in disease management programs.

What are biopesticides?

The U.S. EPA defines biopesticide as “a type of registered pesticide derived from such natural materials as animals, plants, micro-organisms and certain minerals.” Any product sold in the U.S. that makes disease-, pest- or weed-control, or growth-regulation claims must be registered with the EPA or have its active ingredient officially exempted by the EPA. Under federal law, companies selling pesticides (chemical or biological) must show that their products are reasonably safe to humans and the environment and provide some level of control of pests. Exempted products include beneficial insects and arthropods, non-GMO plants and certain minimum-risk pesticides. Though an active ingredient may be exempt from registration, the EPA may still regulate it.

The EPA breaks-down biopesticides into the following three categories:

- **Microbial Biopesticide**—A product that contains a microorganism (i.e., a bacterium, fungus, virus or protozoan) as its active ingredient. Examples include:
 - Fungal: RootShield, RootShield Plus, SoilGard
 - Bacterial: CEASE, Actinovate, Double Nickel, Mycostop
 - Viral: AgriPhage
- **Biochemical Pesticide**—A naturally occurring substance that controls pests by a non-toxic mechanism. Examples include:
 - Plant extract: Regalia
 - Soft chemistry: MilStop, Armicarb (plant disease control)
- **Plant-Incorporated Protectant**—A pesticidal substance produced from genetic material added to a plant. Currently, there are no plant-incorporated protectants registered for ornamental crop production. Therefore, this article will not address them further.

What do biopesticides do?

1. Provide safe and effective approaches to plant disease and pest management. Most biopesticides work preventively rather than curatively. Hence, once the plants are damaged and pathogens or pests have entered the plant, most biopesticides cannot restore plant health or eradicate pathogens from the plant. Biopesticides are effective at low-to-moderate pathogen pressures. Generally, biopesticides have safety profiles that permit low restricted-entry and post-harvest intervals for workers, added safety for end users and the environment, and possibilities for use in bioorganic production.

2. Suppress plant diseases via one or more modes of action. Microbial and biochemical biopesticides used for disease management typically possess two or more of the following modes of action (MOAs):

- Antagonistic metabolites—Materials produced by an organism that are detrimental to pathogens
- Nutrient competition—Inhibiting colonization or pathogen activity by reducing pathogen access to essential nutrients
- Niche competition—Reducing or preventing pathogen colonization by crowding-out or excluding pathogens

from the plant environment

- Rhizosphere or phyllosphere competence—Growth that covers plant parts to block pathogen access to the plant
- Predation or parasitism—Physical attack and consumption of the pathogen by a microbial active ingredient
- Non-toxic mechanisms—Physical or chemical damage to pathogens or inhibition of pathogen activity by membrane disruption, desiccation, smothering, prevention of attachment or recognition
- Induced host resistance—Includes systemic acquired resistance and induced systemic resistance

Efficacy of a biopesticide depends on numerous factors including its MOAs, a pathogen's sensitivity to key MOAs, active ingredient concentration, application timing and frequency, environmental conditions, pathogen or pest pressure, and plant condition. In general, resistance to biopesticides is less likely to develop than with many chemical pesticides largely because multiple, non-specific MOAs are involved for disease control. This makes biopesticides suitable rotation or combination partners to enhance control and to prevent pesticide resistance in conventional, sustainable and organic integrated disease management (IDM) programs.

3. May provide other beneficial effects. Microbial biopesticides have especially been known to promote plant growth, enhance availability of nutrients, increase stress tolerance, improve soils, and promote other beneficial organisms on or near crop plants.

What can't they do?

Despite all of the positive characteristics of described above, biopesticides have limitations. First, they don't offer 100% protection against diseases—no pesticide does. Next, most cannot act curatively. Also, they don't work effectively in environmental extremes and at high pathogen pressures. Biopesticides typically have limited shelf lives, storage conditions and persistence in the field or on the plant, especially those with bacterial or fungal active ingredients. Finally, biopesticides cannot make a bad grower good.

Keys to successful use of biopesticides

Listed below are basic IDM practices that specifically incorporate the use of biopesticides for ornamental greenhouse and nursery crop production.

1. Limit exposure to pathogens and pests by using good cultural practices
 - Use good plant hygiene and remove prior crop residues
 - Use “clean” growing media and soil amendments—only high-quality, stable composts and barks
2. Reduce favorable conditions for disease development
 - Environmental conditions
 - Irrigation water quality and pathogen loads—effective water filtration is essential for irrigation water drawn from surface water sources and for recycled irrigation water
 - Growing medium or soil properties
3. Start with “clean,” healthy plant material
4. Provide proper nutrition management—avoid excesses and deficiencies
5. Know your enemies
 - Potential pathogens and their life cycles
 - Vectors or sources
 - Vulnerabilities and limitations—important for timing of some biopesticide applications

- Available chemical and biological treatment options
6. Select the correct biopesticide for the job
 - Ask the manufacturer or distributor when in doubt
 - Learn from the manufacturer and other growers what kinds of results to expect
 7. Use only registered biopesticides
 - Legal recourse is difficult with unregistered product failures or safety issues
 - Best technical support and customer care comes from manufacturers of registered products
 8. Apply biopesticides from the beginning of each stage of production and at recommended intervals—most biopesticides are preventive
 9. Follow biopesticide label instructions—ask the manufacturer or distributor if you have questions or concerns
 10. Learn how biopesticide products can be used in rotation or combination with other products
 - Especially important if infested plant material or soils are expected or unavoidable

Following these guidelines should provide a practical general framework to get started using biopesticides in your operation. **GT**

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