

GROWERTALKS

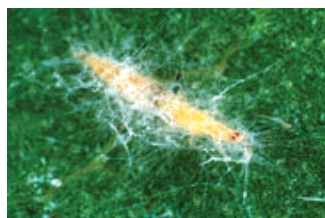
Features

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Biopesticides: What Are Your Options?

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While pests and diseases are here to stay, pesticides have come a long way since the days of DDT, arsenic or lindane.



Since the 1950s, there's been a move to more selective and less-toxic materials. Currently, growers have available to them an increasing array of new generation pesticides that promise to manage pests with less risks to their plants, workers and the environment. Among them, biopesticides are the fastest-growing crop protection market sector. According to market research, the U.S. biopesticide market will reach \$1.25 billion by 2020, growing at over 10% CAGR, which far exceeds the 2% to 3% for conventional pesticide products.

Pictured: A Western flower thrips killed by a fungal biopesticide.

Understanding biopesticides

Growers considering the use of biopesticides should familiarize themselves with the active ingredient from the product label (provided in Table 1 - [see digital edition](#)) and its mode of action. Some biopesticides for plant diseases have multiple modes of action. Biopesticides generally work best when used early in the pest cycle and should thus be accompanied by a pest monitoring program. Moreover, many biofungicides are required to be used preventatively and should be introduced before any diseases become established.

Most product labels contain a lot of useful information regarding application rates, timing and effective use strategies, including compatibility with other agrochemicals and sometimes insectary-reared biological control agents. Label instructions must be followed carefully. There are some general differences between biochemical and microbial-based products. We'll briefly review some examples of each.

Biochemical biopesticides

Various plant extracts and other naturally occurring substances are produced and marketed as "bio" herbicides, insecticides, fungicides, bactericides, nematocides and soil fumigants. Many of these materials, such as non-systemic "contact" pesticides, mean that good spray coverage is needed on the target pest or at

the target site in order to be effective. Others, such as azadirachtin and potassium silicate, can be taken up by plants through roots and are weakly systemic in the leaves.

Some plant extracts (e.g., capsaicin) work through naturally repelling pests, in addition to killing them. Some biopesticides work indirectly and are required to be tank mixed; for example, farenzol (3,7,11-Trimethyl-2,6,10-dodecatriene-1-ol) is labelled as a “behaviour modifying biochemical to be used in combination with miticides.”

Due to their non-specific mode of action, some minerals (e.g. soluble potassium silicate) are labelled as fungicide/miticide/insecticide combinations. Harpin proteins are another recent category of biochemical biopesticides labeled as “plant health promoters” with no direct killing effects on pests listed/claimed. These proteins work indirectly by activating plants’ natural growth and defense mechanisms. Treated plants thus have growth benefits while becoming more resistant to a range of fungal, bacterial and viral diseases occurring during growth and also post-harvest. Since the residues of most biochemical pesticides break down rapidly in the environment, they may also need to be reapplied periodically to maintain pest suppression effects through the crop cycle.

Microbial biopesticides

Products based on specific strains of the soil bacterium *Bacillus thuringiensis* are available to manage caterpillars and some beetles in greenhouses, while strains of the fungi *Beauveria bassiana* and *Paecilomyces fumosoroseus* are similarly available to manage whiteflies, aphids, thrips, leafminers, plant bugs and some soil pests. These materials are most effective against the younger life stages of these pests and before populations build up to large numbers.

Combination products are also now available. For example, BotaniGard MAXX consisting of pyrethrins formulated with *B. bassiana* (botanical and microbial) provides multiple modes of action to control a wider variety of arthropods. Beneficial nematodes, used for management of thrips and other greenhouse pests, are exempted from EPA registration. Microbial products developed as biofungicides include strains of soil bacteria *Bacillus pumilis*, *B. subtilis*, *Pseudomonas chlororaphis* and *Streptomyces lydicus*, as well as the soil fungi *Coniothyrium minitans*, *Gliocladium virens* and *Trichoderma harzianum*.

Several biofungicide products, such as those based on *Trichoderma harzianum*, are marketed as “inoculants” due to their ability to colonize the soil or leaves, and prevent harmful diseases from establishing on the plant. They’re thus generally used preventatively, such as when transplanting seedlings.

Since many microbials are based on living organisms, they have a limited shelf life and may need to be refrigerated until use. Many start-up companies, as well as multinationals, are now screening the soil and plant “biome” to develop new biopesticides and biostimulants. Investments in this area may result in new products based on currently unknown microbes.

Keys to success

Biopesticides are often used where prevention or suppression is emphasised or in integrated programs with other technologies. They, therefore, tend to have more specific use requirements when compared with conventional pesticides. The following tips will help growers’ successful transition to biopesticides.

- **Plant hygiene.** Use clean media and plants, and remove contaminated plant material to prevent pests building up to levels at which biopesticides will not be effective. Monitor for pests and diseases and use biopesticides early in the pest cycle or preventatively based on the label.
- **Rotations.** Rotate biopesticides with conventional products to provide additional modes of action to control multiple pests and limit the ability of pests to develop resistance to any single material.
- **Tank-mixing.** Many biopesticides, such as azadirachtin, are effective or recommended as tank combinations. Some products have “sub-labels” depending on whether they’re tank-mixed.
- **Product selection.** Follow label instructions, and use registered products to avoid legal issues with product failures or safety concerns. Consult with manufacturers, distributors, university extension personnel and others experienced with biopesticides effective for your growing operation.

Following these guidelines for biopesticides will help growers manage greenhouse pests while meeting demands for pesticide residue-free food and products. **GT**

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