

# A New Look at Tank-Mixing

Combining two biopesticide products—and even pairing synthetic and biopesticide products—can help growers keep problems under control.



## WHAT GROWERS ARE SAYING

**“We have found BotaniGard to be a very effective addition to our thrips control program, especially in managing resistance to conventional chemicals. Last summer we found very significant drops in pest numbers after two applications of BotaniGard when other controls were proving difficult.”**

– *Gina Falcetti-Arnold,  
New Products Grower,  
Skagit Gardens Inc.,  
Mount Vernon, Wash.*

Over the years, growers have seen a lot of changes regarding pest management. In the past, synthetic control products were the norm. Then came an increased awareness of environmental toxicity and the rise of pest resistance issues. A new strategy was needed. Control products became more pest-specific and not as broad-based. The result? A new set of learning curves that had to be navigated.

Meanwhile, another option has entered the arena. Biopesticides have emerged as a less toxic and safer alternative to many synthetic products. However, many growers are grappling with how to add these control products into their current mix. What they’re discovering is that biopesticides can be paired to create extremely effective mixtures, and they can also be coupled with select synthetic products to achieve

desired results. This versatility has piqued the interest of many growers. In general, biopesticides do not have resistance issues due to a broad-based mode of action. Many biopesticide labels do not have restrictions on the number of uses per year or even per crop, though some of them may.

Here’s a common scenario: During periods of severe pest pressure or a flare up, a grower can use a synthetic material, tank-mixed with a biopesticide as a control strategy. Or, use the synthetic as a clean up or quick knock down, followed by the biopesticide for maintenance.

To take it one step further, in many cases synthetic chemicals may not be needed. By using biopesticides initially in a preventive manner, and closely monitoring the pest population to precisely time subsequent applications (not based on a calendar schedule), growers can often complete a crop without chemical pesticide inputs.

As with any new product or set of controls, there will be a learning curve, but incorporating bio-pesticides into a synthetic-based program can be simple and complementary to the program already in place.

## BIO-CONCEPTS EXPLAINED

When you begin exploring options, it’s important to understand three distinctions:

- “Biopesticide” is an umbrella term. It refers to pesticides that are derived from natural materials such as plants, micro-organisms and certain minerals.
- “Biochemical pesticides” refers to naturally occurring materials that control pests by non-toxic mechanisms, such as mating disruptors, attractants or repellents.
- “Biotechnology” is the development of products by a biological process using organisms like bacteria or substances such as enzymes.

These elements are the key components of BioWorks’ products, that provide growers options that fit perfectly into resistance management programs. The products offer alternatives to chemical pesticides, and can be used alone, in a tank mix, or in rotation as part of an integrated management program.

Many of BioWorks’ products employ multiple modes of action, which curtails

## RESISTANCE AND TANK MIXING

One challenge that growers face is resistant pests. When the pesticide program they once used no longer controls the pest population, other pest management practices need to be explored. Resistant pests are born with the resistance; it does not occur during its lifetime, nor at the species level, but at the population level. Resistance is determined when the pest survives exposure at rates which once controlled them or repeated use of a specific chemical.

Another way to create resistance is with the use of multiple chemicals that feature the same or similar modes of action, especially when used in a tank-mix. 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. Additionally, because many pests have high birth rates and multiple generations during a growing season, the chances of these populations developing resistance is increased. Their offspring have a higher likelihood of being resistant to chemicals used.

When tank mixing, it is important to avoid antagonism. Antagonism, such as significant differences in pH, reduces the effectiveness of the mixed products – in other words, the mixture becomes less effective at controlling pests. Physical incompatibility can also be an issue and should also be avoided. This occurs when two or more products are combined but do not mix properly. Most manufacturers have compatibility charts available to ensure this does not happen, or growers can test compatibility themselves using the simple “jar” test.

**WHAT  
GROWERS ARE  
SAYING**

“Cease and MilStop are used to control and eradicate powdery mildew infestations in our chard and carrot crops. As an organic grower, we continue to have great success with BioWorks products.”

– Robert McClendon, Owner, McClendon’s Select, Peoria, Ariz.

“A foliar disease on Rieger begonias was “stopped in its tracks” after the second application of a tank-mix of Cease and MilStop. A pathology report from Penn State revealed the problem was a Xanthomonas-like disease.”

– Joe Volpe, General Manager, Peace Tree Farms, Kintnersville, Pa.

development of pest resistance. Resistance management should be a broad-based effort and include multiple tactics – chemical, biological and cultural. However, strategy should be developed in advance. Waiting until the population becomes resistant before establishing a resistance management program simply will not work.

### A MULTITUDE OF OPTIONS

BioWorks products create multiple modes of action and combinations.

BotaniGard’s active ingredient is a my-

coinsecticide based on Beauveria bassiana strain GHA. When the microscopic spores of the fungus come into contact with the body of an insect host, they germinate, penetrate the cuticle and grow inside, killing the insect within a matter of days.

SuffOil-X’s mode of action is suffocation of eggs, larvae, nymphs and adults of soft-bodied insects and mites. As a fungicide it does not allow the fungal spores or mycelia to attach to the leaf.

Molt-X has multiple modes of action. It works primarily as an insect growth

regulator that disrupts the molting process in insects. It also acts as an insect repellent, anti-feedant and ovipositional deterrent.

Cease is a biological fungicide that contains a patented strain of the bacterium *Bacillus subtilis*, QST 713.

MilStop is an EPA-registered, potassium bicarbonate-based foliar fungicide that kills powdery mildew on contact by pulling water from spores and their growing strands. It also inhibits enzymes involved in fungal cell wall formation by altering the pH on the leaf surface.

### PROPER PAIRINGS

- Choose BotaniGard as a tank-mix partner with Molt-X for an effective defense against resistant insect populations. BotaniGard controls insects with a high concentration of living spores of the powerful fungus *Beauveria bassiana* GHA strain. Molt-X (BioWorks’ newest product) allows BotaniGard more time to work by disrupting the molting process. Together, they have proven efficacious in controlling insects while providing plant, human and environmental safety.
- A tank mix of Molt-X and SuffOil-X provides a great combination to give target pests a devastating one-two punch. The suffocating power of SuffOil-X provides a quick knock-down of adult pests, while Molt-X works to disrupt the insect’s lifecycle, feeding and oviposition activity.
- Cease and MilStop have worked well together as a combination application, giving an added boost in controlling bacterial pathogens such as *Erwinia*, *Xanthomonas*, *Pseudomonas* as well as fungal pathogens that cause botrytis rot, powdery mildew, and other foliar diseases.
- In addition to the BioWorks family of products, Cease, MilStop, Molt-X, SuffOil-X and BotaniGard can be mixed with many other commonly used insecticides and fungicides to provide a greater range of protection. Compatibility charts are available on the BioWorks Web site at [www.bioworksinc.com](http://www.bioworksinc.com). ■

## RESOURCES



### BOTANIGARD COMPATIBILITY CHARTS:

1. <http://www.bioworksinc.com/products/shared/insecticide-compatibility.pdf>
2. <http://www.bioworksinc.com/products/shared/fungicide-compatibility.pdf>

### 3. SUFFOIL-X MODE OF ACTION CHARTS:

<http://www.bioworksinc.com/products/shared/mode-of-action-chart.pdf>

### 4. MOLT-X PRODUCT INFORMATION:

<http://www.bioworksinc.com/products/molt-x/molt-x.pdf>

### 5. CEASE COMPATIBILITY CHARTS:

<http://www.bioworksinc.com/products/cease/compatibility-chart.pdf>

### 6. MILSTOP SPRAY APPLICATION PROTOCOLS:

<http://www.bioworksinc.com/products/shared/small-volume-rates-cease-milstop.pdf>