

Breaking Down Biopesticides

Commercially available biopesticides fall into **two major categories** – Microbial Biopesticides and Biochemicals. A quick look at the types of biopesticides found in each:

Microbial Biopesticides

Bacteria

Unicellular organisms with pesticidal properties manufactured through industrial fermentation. These products target fly and beetle larvae, caterpillars, fungal and bacterial diseases, and soil-borne pathogens.

Viruses

Non-living organisms that act as intracellular parasites, invading the host cell's nucleus and causing the reproduction of new viral particles. Products include nuclear polyhedros viruses (NPVs) and granulose viruses (GVs). Used to infect such insects as armyworms and bollworms.

Fungi

Fungal biopesticides emerged in the 1980s and may display nematocidal, mitocidal, insecticidal, and/or herbicidal activity. Also includes a small group of products that control post harvest pathogens tied to fruit decay. May also be manufactured through industrial fermentation. Dependent upon favorable environmental conditions.

Nematodes

Act as insecticides by invading insect larvae through bodily openings and releasing toxic bacteria that kills the host. May be dependent on environmental conditions.

Biochemicals

Plant Growth Regulators

Naturally occurring hormones and synthetic compounds that can promote, inhibit, or modify plant physiology or morphology to optimize yield and crop quality.

Insect Growth Regulators

Chemical substances which disrupt the action of insect hormones controlling developmental stages such as molting, maturity from pupil stage to adult, and others.

Plant Extracts

Botanical compounds that may exhibit herbicidal, fungicidal, insecticidal, or nematocidal properties.

Pheromones

Synthesized chemical substances used for insect trapping and mating disruption.

Mineral

Natural minerals that act as coatings such as kaolin clay or phosphite materials and others that stimulate plant defenses.



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Understanding **Biopesticides**

- **Delivering Value**
- **Dispelling Misconceptions**
- **Enhancing Your Program**

In many markets, growth in biopesticide sales is outpacing traditional chemicals. In this Special Report, we explore the basic value proposition of biopesticides both for dealers and growers, investigate the myths surrounding their use, and discuss and what suppliers need to know when evaluating both products and potential suppliers.

Unique, Effective and Market Driven

The more full-service dealers and growers are becoming comfortable with the science behind these products and how they are used, the more value they're delivering to the market.

Benefits

Associated with Biopesticides

GROWER needs revolve around a system of inputs and services that enable them to grow high quality crops and maximize profits. But managing how those inputs come together is where the real art form comes in.

As the grower's most relied upon resource for introducing new tools, technologies, and practices that can benefit their program, dealers, distributors, and technical advisors use that artistry to differentiate themselves from their competitors. Factor in favorable market conditions and increased demand for products that can maximize output, and you wind up with an acceleration of interest in biopesticides at both the dealer and grower levels.

The Market Determines What Works

Biopesticides are gaining newfound respect, but the technology itself is not new. What's changing is simply their level of acceptance within today's production schemes.

The first biopesticides emerged in the 1960s with the advent of *Bacillus thuringiensis* (Bt) insecticides and early plant growth regulator products (PGRs). But as the category broadened over the next several years, a dubious reputa-

- Enhance Crop Quality and Shelf Life
- **Operate Effectively in Rotation with Traditional Chemicals**
- Resistance Management Tool
- **Help Maintain Beneficial Insect Populations**
- Provide Labor and Harvest Flexibility
- **Provide Supplier Differentiation**
- Environmental Safety Benefits

tion developed around biological products, slowing their adoption in the '80s and '90s. The problem was two-fold: 1) For products that actually display pesticidal activity, the manufacturing process is highly complex. Only companies with strict quality control standards were making sound products; and 2) Less stringent efficacy requirements for "natural" products meant that it was easier for sub-par manufacturers to bring sub-par products into the marketplace and make pesticidal claims. Viable biopesticides suffered by association.

Fortunately, the market has a way of sifting out good products from inferior ones. Products that didn't live up to their claims were quickly discarded, and products that did per-



Estimated
Application Volume
For Biopesticides

95% Conventional
Production

Only 5%
Organic Production



form well have continued to penetrate the market and improve as formulation technology has furthered. Today, biopesticide sales are on the rise. Since the early 2000s, in markets where biopesticides are sold, growth rates are generally higher than for traditional chemicals, sometimes by a factor of two.

There are several reasons why. First, retailers and growers are becoming more familiar with the science behind these products. They understand the need for multiple modes of action, and a biopesticide's role in a grower's resistance management program. Secondly, the benefits that biopesticides offer are more clearly understood (see "Benefits Associated With Biopesticides"). Biopesticides not only extend the product life of traditional chemicals, but they can add flexibility to harvest timing and re-entry times. They also can affect plant physiology and morphology in ways that maximize yield, pack out, and often the efficacy of tank mix partners.

Still Work to Do

Biopesticide manufacturers admit there's still work to be done. Despite a higher degree of understanding and

higher adoption, there are still dealers and growers who could benefit from biopesticides, but remain unclear about how the products work, what the specific benefits are, and what to expect when using these products. Some may have had a bad experience with a biological product making exaggerated claims in the past. Others may simply be adverse to change. But in either case, without a high degree of confidence, that transition cannot take place.

Mike Donaldson, president and chief operating officer of Valent BioSciences (VBC), says that matching expectations to reality is a key first step to realizing biopesticide benefits.

"A key area of focus for us is helping the distribution channel, and their customers, understand that these products operate differently than traditional products," Donaldson says. "You apply them differently, timing is especially important, and the pests may react differently than they do to with conventional products."

Bo Cranford, a sales representative for UAP operating in the Mississippi Delta, echoes Donaldson's thoughts on the need for education when adopting

biopesticides. "We handle biological seed treatments, for example," Cranford says. "We're putting that organism into the soil and there's a certain amount of time required for it to reproduce and provide control. So in lots of cases, we want a good tank mix that will get along well with the biological and give us control until that population builds up. The two products work together, and grower has to understand that whole picture."

He offers another example of Bt applications, where the product binds the gut of the target pest and starves it to death. "The grower is used to 'see bug, kill bug,'" Cranford laughs. "So if we do a foliar application with some of these products, the grower has to understand that pest is going to have to feed, ingest the biological, and then once it does, we'll still see it in the field for a few days before it dies. It's still there, but it stopped feeding the first time it took a bite. That takes some getting used to."

Cranford says that for dealers, choosing a supplier partner that has a strong support system in place makes all the difference, especially if you're just learning. "The manufacturer has to do a really good job of testing, like giving us

Debunking the Myths

Manufacturers cite the following as the most common misperceptions about biopesticides:

MYTH: All biopesticides are alike.

FACT: Quality can vary widely. It's easy to see which biopesticides have value by what's being used in the marketplace.

MYTH: Biopesticides are difficult to use.

FACT: There is a learning curve, but they can deliver significant value when used properly.

MYTH: Biopesticides are intended to replace traditional chemicals.

FACT: Most biopesticides are intended for use in conjunction with traditional chemicals.

MYTH: Biopesticides are only for use in organic production.

FACT: Only about 5% of all biopesticide use is for organic applications.

MYTH: Biopesticides are not reliable.

FACT: Biopesticides are reliable when used properly. It's important to be educated before using them; a dealer should only partner with established suppliers that offer strong technical support programs.

those best tank mixes, for example. If I'm dealing with a live organism, the last thing I want to do is put something out there that can adversely affect the biopesticide. If you're new to these products and don't have the experience yet, it's not like you just know what works with them and what doesn't. The good manufacturer will provide you with all of that information up front."

Partners, Not Replacements

John Wilke represents one of the manufacturers that supplies UAP, and provides the kind of information Cranford needs. Wilke joined Becker Underwood as its inoculant product manager in 2004, and sees the myth that biopesticides are intended to replace traditional chemicals, rather work in conjunction with them, as one of the biggest barriers to adopting biopesticides (see "Debunking the Myths").

"That's a real hot button for us," Wilke says, "helping people understand that these products are complementary

to conventional products, not stand-alone products. Once we can get past that point, we've made significant progress. Then they'll consider what the unique benefits might be. We do have some products for organic production that stand alone, but the vast majority of our products are meant to be part of an overall program."

Bill Foster is president and chief executive officer of BioWorks Inc., a leading producer of biological fungicides and insecticides for the horticulture and specialty agriculture markets. Like Donaldson and Wilke, Foster makes sure that the compatibility message comes through loud and clear in his marketing programs.

"We don't kid ourselves," Foster says. "In addition to being efficacious, our products have to be compatible just to get in the door with these guys. They have to perform, they need to store well, they need to work in rotation or as a tank mix with other products, and we have to provide strong technical and application support. Because that's what conventional products offer."

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Working biopesticide products into your mix of offerings opens up a world of service opportunities to market to existing customers, and avenues for approaching new ones.



WITH increased prices across many crops these days, as well as the increasing interest in growing organically, growers are ready and willing to try products and practices they never previously considered.

The vast majority of growers rely on you, the full-service retailer, to provide valuable advice on the agronomic practices and products they will use in the production of their crops. Your reputation rides on every product used and every action taken in the field.

This is one of the key reasons why biopesticide products have been slow to take hold in many regions and in many crops. As the trusted advisor, you need to have full confidence in the products and practices, or you'll simply put them aside. And in the past, biopesticides did not have a proven role in enhancing an overall crop production regimen.

Today's biopesticides, and many of the companies that manufacture them, have changed dramatically. They are no longer a crop production solution in search of a problem — manufacturers have been working hard to understand the crop production process and have geared their research toward building biopesticide solutions to problems with which growers need help. They are also working closely with you to determine the best way to bring these solutions to growers.

Working with biopesticide products is not that much different than working with "conventional" chemistries and traditional cropping programs, but present unique modes of action and agronomic practices that must be fully understood. Retailers who are using these products successfully, and the manufacturer representatives that help them, share a number of tips for successfully integrating biopesticide products.

Understand And Evaluate

Biopesticides provide different benefits depending what product is used, what crops they are used on, and what they are designed to accomplish. So it becomes critical to first understand how a biopesticide product is designed to work in a given cropping program, and then to thoroughly evaluate the product based on the potential benefits.

Four years ago, Ag Partners Coop, Hiawatha, KS, was introduced to Vault LVL microbial seed inoculant through the product's manufacturer, Becker Underwood. Ag Partners' Mike Sudbeck says that the retailer was evaluating products for increasing soybean yield, and that Vault was one

Are Biopesticides Right For You?

Biopesticides aren't for everyone. The most likely candidates for biopesticide adoption are progressive dealers and growers who are open to new technologies and consider a broad range of factors when making product selections. Adapted from their "Guide to Understanding and Evaluating Biorational Products," Valent BioSciences uses the following checklist to characterize the kinds of dealer/distributors and technical advisors most likely to recommend biopesticides in their programs:

- Trained in ag economics
- Emphasize resistance management strategies
- Emphasize productivity
- Emphasize justifying recommendations through research
- In tune with changing consumer preferences
- Seeks continuous education on pesticide technology
- Serves all segments – has a broad customer base
- Has customers who are technologically inclined
- Has customers who want to reach export markets
- Wants a broad portfolio of complementary products
- Helps customers to manage life span of traditional chemicals

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Getting Started

Choosing Products and Partners

Dealers already active in the biopesticide market suggest that the following rules of thumb should figure prominently in your assessment of potential products and manufacturing partners:

1 Company/Product History: Well established is safest. Up and comers may offer value, depending on rules 2 - 4.

2 Efficacy – How Are These Products Tested: Good data is important, and there's often none better than your own. Conduct trials to validate claims and gain experience.

3 Quality Assurance: Know and understand your manufacturer's quality control system. Confidence in receiving consistent product is important.

4 Product Support: Factors include technical support, setup, inventory management, and how suppliers demonstrate their willingness to stand behind their products.

of a number of products under consideration.

Vault LVL is a low-volume liquid inoculant that combines strains of beneficial rhizobia with an EPA-registered biofungicide called Integral. The Vault LVL package suppresses diseases while promoting nodulation and improving nitrogen utilization in soybeans. Integral contains a patented bacterium – *Bacillus subtilis*, strain MBI600 – which grows quickly with the developing plant root system, and in so doing produces a novel “protective” antifungal metabolite. This novel metabolite has the potential to suppress the growth and negative impact of a number of fungal root pathogens, thereby resulting in improved plant growth and performance, according to Piran Cargeeg, technical development manager at Becker Underwood.

In the education process, manufacturers should play a key part in establishing expectations for both the retailer and the grower. “Becker Underwood worked with us in helping understand the product and to determine our needs,” says Sudbeck.

For example, Vault requires storage at a stable temperature (at or below 77 degrees F), and the product has a more limited window of application once applied to the seed. This is not atypical with biopesticides – viability windows and tank mix compatibility vary from product to product and application to application, and this must be considered when planning to add a biopesticide to your product portfolio.

With a clear understanding of the product, the next step is evaluation. “All of the agronomists here came from a research and consulting background,” says Sudbeck. “We base our evaluations first and foremost on what brings a return to the grower.” As with conventional products, nothing beats on-farm research, and Sudbeck and his team directed many side-by-side trials to show growers the potential benefits of Vault LVL.

Educate and Market

Of course, getting growers to try something new is always a challenge, and especially so when it comes to biopesticides. Education is critical, notes Sarah Markle, one of three Florida sales representatives for Valent BioSciences.

“We will help conduct large grower meetings, meet with the distributor alone, or go on one-on-one sales calls with the distributor representative,” says Markle. “The training can take on many forms.”

As with conventional chemistry, programs are also a key discussion point with the distributor, says Markle. “Distributors want to know what they will get at the back end of the season,” so program details are hammered out well in advance.

To alleviate the risk of failure, Ag Partners Coop worked with Becker Underwood to implement a program called Betcha' A Bushel. Growers were asked to buy into the program with the guarantee that they would increase their yield by at least one bushel. This more than pays for the program, says Sudbeck, and provides peace of mind for the grower who's concerned about efficacy.

Becker Underwood has provided the program support, including literature, advertising, side-by-side test plots, and grower meeting sponsorship.

Assess and Grow

As grower meetings evolve into proven field results and grower “buzz” about the products, harvest time and the off-season is the time to capture the momentum and get growers back on board quickly.

Sudbeck has implemented an aggressive fall signup program for Vault LVL. Ag Partners Coop offers free soybean seed delivery and 100% soybean replant, backed by Becker Underwood, when the program is prepaid in the fall.

After four years, the buzz that the combined marketing effort generated has resulted in wide adoption by growers – Sudbeck says that 85% of his grower-customers are now using Vault LVL on soybeans.



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Different Message, Different Dealer

At Cascade Ag Services, getting the message out about the benefits of biopesticides is half the battle.

In many regards, Cascade Ag Services is your average ag retailer. Based in Wenatchee, WA, this decade-old operation supplies crop protection solutions for a variety of apple, pear, and cherry growers in the Pacific Northwest. “I guess you could say we are pretty normal in that regard,” observes Mike Hodge, head of field staff for the company. “For one thing, we operate under the same principle as most retailers in our area, in that you can’t have losses based on the crop protection products being used. We are catering to a high service grower industry with a permanent crop, so we can’t screw up.”

But unlike other retailers in its part of the country, Cascade Ag Services is a big advocate of biopesticides. In particular, says Hodge, the company provides *Bacillus thuringiensis* (Bt) products to its grower-customers, as well as products that kill codling moth infestations using a naturally occurring virus. For many of its cherry and apple growers, he adds, biopesticides are used as a way to fight against possible resistance issues in various types of powdery mildew that plague both fruit trees.

“Many dealers don’t seem to want the hassle of handling biopesticides,” says Hodge. “I think part of the reason may be it’s sometimes hard to maintain a good profit margin on the biological products because they are not supported by any kind of a rebate program such as traditional crop protection products tend to be.” Also, he adds, many earlier biopesticides were unable to deliver on their control promises because of poor production methods or inappropriate testing procedures. For example, contamination can lessen the efficacy of many biopesticides. In Bt production, the bacterium used to make the product can be susceptible to infection by organisms known as bacteriophages, which can weaken or destroy Bt, rendering the end product unable to control insects.

Different Time, Different Attitude

But the biopesticides marketplace is a much different place today than it was in the past, says Hodge. Still, the learning curve is steep for the retailer when it encounters a grower that hasn’t used these kinds of products before. “Our job in these cases is to educate these growers, letting them know that when used properly, biopesticides can pay off for them and offer other environmental benefits when compared with the use of conventional crop protection products,” he says.

Microbial pesticides such as Bt deliver ROI in several ways: By providing narrowly targeted options that maintain beneficial populations; by preventing resistance and helping restore the efficacy of products previously lost to resistance; and often by

reducing applications of traditionals. The combination of all of these factors can reduce total pest control costs. Luckily, adds Hodge, this concept is getting easier to explain to growers.

“Growers today seem to be more open to using biopesticides in their operations because the need is there,” he says. “Many of them are looking for control products that can help speed up application and last longer in the field. It also helps that the proper use of biopesticides can help a grower cut down on their fuel and labor costs because most of them can be applied at the same time as other crop protection products.”

Also instrumental to the change, says Hodge, is the fact that many of the major players in the biopesticide marketplace these days are long established and respected crop protection product companies. “That’s the main difference today compared with a few years ago,” he says. “Today, there are several well-known companies in this field — ones that have the technical expertise to thoroughly test these products before they ever bring them to market. You have to have good resources behind biopesticides, I think, before you make the leap with many growers and convince them to give them a try.”

Rather than bringing a single questionable or unproven product to market, says Hodge, these established manufacturers are able to offer retailers and growers dozens of different products, all that have been created and tested under very demanding conditions.

“These companies supplying today’s biopesticides are more tech savvy than ever before,” he says. “Also, they are much better with their support and quality service for distributors like our company, giving us plenty of help and information so that our growers can be successful and profitable when they use these brands.”

In addition, says Hodge, many growers are continuing to move away from the use of organophosphates in their operations, which bodes well for future biopesticide usage. “Many of our growers are dealing with a very short pre-harvest interval,” he says.

“To capture peak efficiency in this kind of climate, biopesticide products support that production window very nicely.”





Different

By Design

Mike Hodge of Cascade Ag Services says that his company's willingness to embrace biopesticide technology helps set it apart from the competition.

Technical Know-How

"Biopesticides have made us more technically savvy. We have to keep up on them all the time, so it keeps us on our toes."

Customer Loyalty and Referrals

"I think we have more loyal growers than any other company around because they can see that we know what we're doing with these products and they come back to us. Other growers notice."

Big-Picture Value

"Growers are always looking for ways to shave costs. If a product extends the value of companion products, or has a longer residual, it's worth it even if it costs a little more. They're starting to understand that."

More Complete Company

"Including biopesticides can make decision making more challenging day to day, but it makes us better stewards of the industry and our growers in the long term. We want to grow as a company, but not with low prices. It's with quality service and carrying a full line of products that we understand fully and can educate the grower on so that they can reap the benefits."

Mike Hodge,
Cascade Ag Services