NEW BIOPESTICIDES FOR GREENHOUSE CROPS

Are you seeking biological controls to protect your plants? These four new products are worth trying out.

BY A. R. CHASE

When I started my career, about 40 years ago, biological control was known and studied but not in practice in many parts of agricultural production. Today we have come far with several new products launched annually. In most cases, these products are as well researched and understood as currently launched conventional fungicides.

In many cases, the companies launching the products also produce conventional fungicides but sometimes they focus primarily on biopesticides. In this article I have decided to focus on four of the newest biopesticides that have reached the greenhouse/ornamentals market. Each of the four products below are OMRI-listed. I have not placed them in any particular order.

STARGUS BIOFUNGICIDE

Marrone Bio Innovations

The active ingredient in Stargus Biofungicide is listed as a beneficial rhizobacterium that colonizes plant root hairs, leaves and other surfaces to prevent establishment of fungal and bacterial plant diseases. The active agent is *Bacillus amyloliquefaciens* strain F727* cells and spent fermentation media.

The label lists disease control for Botrytis species (gray mold), powdery and downy mildews, black spot on citrus, Phytophthora blight and late blight. It is also registered for some soil-borne pathogens including Fusarium, Phytophthora, Pythium, Rhizoctonia and Sclerotinia species as well as some others. Check Table 1 for a summary of efficacy trials that have been done on all crops (including experimental trials on ornamentals).

Stargus is currently registered on edible field crops including a long list of herbs and spices. As far as I can tell, it it not registered for ornamentals specifically. It has a four-hour REI and a signal word of CAUTION.

Best disease control is achieved when Stargus is applied preventatively in a regularly scheduled protective spray program. The manufacturer also suggests using it in rotation or tank mix program with other registered fungicides. The label allows for application flexibility with foliar, aerial, chemigation and soil-applied methods.

PATHOGEN	PLANT	RESULT
Alternaria leaf spot	Brussels sprouts, tomato, potato	None to very good
Botrytis (blight)	Geranium, poinsettia, raspberry, blueberry and strawberry fruit	None to excellent
Cercospora leaf spot	Beet	Very good
Colletotrichum (anthracnose)	Blueberry fruit	Excellent
Erwinia (fire blight)	Apple	None to some
Macrophomina (charcoal rot)	Strawberry	None
Phytophthora root rot	Hydrangea	Very good
Powdery mildew	Raspberry	Excellent
Pseudomonas leaf spot	Mum	Some
Rhizoctonia root rot	Viburnum	Good
Sclerotinia (white mold)	Lettuce, bean	Some to excellent
Septoria leaf spot	Tomato	None
Verticillium wilt	Strawberry	None
Xanthomonas leaf spot	Brussels sprouts, cabbage, geranium	None to very good

Table 1. Stargus efficacy trial summary for all crops.

In a couple of recent trials, Stargus was tested on two soil-borne root diseases on woody ornamental by Baysal-Gurel (Tennessee State University). The crops were viburnum with Rhizoctonia root rot and hydrangea with Phytophthora root rot. Stargus provided control in these two trials that was equivalent to RootShield Plus and nearly as good as the conventional root disease fungicides for Phytophthora (Empress, Segovis and Subdue Max) and Rhizoctonia (Empress and Mural). It is important to note that the application interval in these trials was weekly while the other products were applied on a three-week interval or much longer (RootShield Plus and Subdue Maxx).

PATHOGEN	CROP	EFFICACY
Alternaria leaf spot	Almond, tomato, carrot	Good
Botrytis blight	Geranium (two trials)	None to some
Erysiphe (powdery mildew)	Zinnia (three trials), gerbera	Excellent
Fusarium stem rot and wilt	Cyclamen, Holiday cactus	Slight to some
Monilinia (brown rot)	Almond, peach	Very good to excellent
Peronospora (downy mildew)	Basil, spinach	Slight to some
Podosphaera (powdery mildew)	Strawberry	Some
Pseudomonas leaf spot	Hibiscus	None
Puccinia and others (rust)	Almond, apple, daylily	Very good to excellent
Sclerotinia flower blight	Cyclamen	Some
Sphaerotheca (powdery mildew)	Rose, squash	Some
Wilsonomyces (shothole)	Almond	Excellent
Xanthomonas leaf spot	Begonia, tomato	Good to excellent

Table 2. EcoSwing efficacy trial summary for all crops.

ECOSWING BOTANICAL FUNGICIDE

Gowan

EcoSwing is an extract from Swinglea glutinosa in the FRAC P-05 group. It is preventative and curative and has some SAR capacity. EcoSwing should be applied at the first sign of infection and again on a seven- to 10-day interval. EcoSwing is safe on most plants and compatible with most fungicides and insecticides. Gowan does recommend using a small jar test and spraying a test plant when using any new product or product combination on your crop.

EcoSwing's primary mode of action is to act as a contact desiccant and cell wall disruptor to the fungal hyphae. Preliminary research also suggests that EcoSwing may aid in triggering innate plant responses to help boost plant's natural defense mechanisms against fungal pathogens. Trial works also shows efficacy on some foliar bacteria like Xanthomonas (see Table 2).

EcoSwing is labeled for indoor and outdoor, greenhouse food and non-food crops, vegetable, fruits, herbs, tree nuts, ornamental flowers, trees, shrubs and plants, landscapes, parks, recreational areas, plants growing in containers, interiorscapes, home and garden. It is labeled for nearly all crop types including ornamentals.

BOTRYSTOP

BioWorks

BotryStop is a live spore preparation of a non-pathogenic saprophytic fungus, *Ulocladium oudemansii* strain U3. BotryStop aggressively occupies the same physical space and out-competes pathogens for the nutrients and space on the dead and senescing plant tissue; it is a true antagonist. With this mode of action, it is highly unlikely that resistance to BotryStop will develop.

BotryStop is an organic biofungicide for the control of pathogens such as *Botrytis cinerea*, *Sclerotinia sclerotiorum* and *Monilinia* spp. BotryStop provides protection to blossoms, fruit and plant tissues form these related fungal pathogens. The product has a four-hour REI. BioWorks has carefully researched this living biological control pageant for compatibility with a wide range or conventional and biopesticide products. This compatibility can be found on their website. Since it is a living fungus, care must be taken not to tank mix or rotate with something that can kill it. It is compatible with most wetting agents and biopesticides. Some of the fungicides that should not be mixed with BotryStop include: Heritage, CEASE, Daconil, Palladium, Chipco 26019, Dithane and RootShield PLUS.

BotryStop is sensitive to heat and special care must be taken to maintain its viabilkity. Shelf life of the product is 12 months when refrigerated — ideally kept below 68° F. Do not freeze the product as it will damage the spores.

PATHOGEN	CROP	EFFICACY
Botrytis blight	Ginseng, strawberry, grape, begonia, peony	Very good to excellent
Monilinia (brown rot)	Cherry, almond, apricot	Good to very good
Pseudomonas leaf spot	Chrysanthemum, zinnia, hibiscus	None to very good
Xanthomonas leaf spot	Begonia, ranunculus	Some to very good

Table 3. BotryStop efficacy trial summary for all crops.

PATHOGEN	CROP	EFFICACY
Alternaria leaf spot	Tomato	Very good
Erwinia (fire blight)	Crabapple	Good
Phytophthora (late blight)	Potato	Excellent
Pseudomonas leaf spot	Blueberry, hibiscus	Very good to excellent
Puccinia (rust)	Daylily	None
Xanthomonas leaf spot	Begonia, tomato, pepper, ranunculus	Good to excellent

Table 4. Kalmor efficacy trial summary for all crops.

We have tested (as well as others) this product for efficacy against currently unlabeled diseases especially bacterial leaf spots like Pseudomonas and Xanthomonas (Table 3).

KALMOR

OHP Inc.

There are a number of copper products available for greenhouse growers. Some are even OMRI-listed including Kalmor from OHP. KALMOR is a dry flowable formulation with 46% copper hydroxide. REI for greenhouse uses ONLY is 24 hours with eye wash stations (refer to the container label for further information). For outdoor uses the REI is 48 hours.

Kalmor works at multiple sites. Absorbed copper disrupts the enzyme systems of the fungal and bacterial pathogens. Kalmor works both as a curative and a preventative fungicide. For best control, apply Kalmor when disease symptoms first begin.

Kalmor may be used on ornamental plants grown in commercial greenhouses and nurseries, and on conifers, vegetables, small fruits and nuts. It can be applied as a foliar spray or drench on ornamental plants at 0.5 to 2.0 pounds per 100 gallons. If Kalmor is applied in a spray solution having a pH of less than 6.5, phytotoxicity may occur. Do not tank mix with low pH products like Aliette or B-Nine. Extended periods of wet weather or very high humidity may result in copper burn. Kalmor has been safe in our trials and has shown high efficacy against many bacterial diseases (our current focus with this product). gpn

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