

FOCUS: GREENHOUSE INNOVATION

Biopesticides and biostimulants: friends with benefits

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The concept of a greenhouse as a controlled environment does not mean a perfect environment. It's a mini ecosystem of plants pushing for light and nutrients amidst pests pulling for a foothold.

Greenhouse growers are further challenged by external forces, not the least of which is the regulatory environment. This means that Canadian growers have a limited access to effective pesticides as older chemistries come off the market and there aren't many replacements. Add pest resistance to the mix and negative consumer perceptions around the use of chemicals, and now, crop protection must evolve.

There has been a move towards a greater use of biological control and with it, an increased use of biopesticides. By nature, biopesticides, challenge the traditional sense of crop protection where a pest is identified and a product applied to take care of the problem – identify pest, kill pest. Instead, biopesticides are a player in an integrated pest management (IPM) strategy, best used before pests become a problem. Ultimately, it's prevention rather than cure.

Whether they are micro-organisms, plant extracts or insect pheromones, biopesticides are compatible with other biocontrol agents. They work in many different ways, killing pests or altering their behaviour to the grower's advantage and all components of the program collectively provide the desired level of pest suppression. And then there are biostimulants which contain micro-organisms or other biologically derived materials that are intended to improve the resilience of the crop while not necessarily controlling pests or diseases.

Many biostimulants are sold as crop boosters as they improve nutrient uptake and stimulate other beneficial functions in the plant, but may not deliver increased yields in every cycle. By enhancing the resilience of the crop, they help the plant tolerate stress – such as high heat or salinity – while remaining productive throughout their growth.

"If we continue to think of these products in the same way as chemistry, then we will be disappointed," says Dr. Michael Brownbridge, research director, Horticultural Production Systems, Vineland Research and Innovation Centre (Vineland). "Chemistry is used as a reactive tool, whereas biopesticides and biostimulants are used as preventive tools."

"It's a little bit like the Wild West out there in terms of the biostimulant market," says Brownbridge. "As an industry, we are faced with decisions on what to use and how to differentiate between products that actually deliver benefits and those that don't."

The problem is that there is no acknowledged protocol for measuring performance. In some cases, growers who use biostimulants may reduce some inputs or see other benefits. In others, they may not be so obvious. It's harder to tell in a greenhouse environment than in an open field environment.

Four years ago, Vineland's researchers started to look at bioinoculants. They are microbial biopesticides and extracts which provide protection against root diseases, stimulate growth or induce a stress response in plants that in some cases affect pest population development.

"We're only just beginning to understand how to reduce the susceptibility of plants to pests and disease," says Brownbridge. "That requires a total change of thinking in terms of how to integrate these biological materials into IPM systems."

The greenhouse industry is currently fighting the pepper weevil, an invasive pest that cost Ontario's industry about \$100 million last year. To date, growers are using a biosecurity approach in terms of screening vents and avoiding bringing in contaminated plant material from offshore.

"Biopesticides can kill the pepper weevil, but just because you can kill the pest in a Petri dish, doesn't mean you can kill the pest in real life," says Brownbridge. "The challenge is getting the active material to the pest, given their lifestyle."

"You can go only so far with genetics and chemistry," Brownbridge continues. "Our ability to manipulate the microbiome – microbes that live on or inside plants or the roots – could be a game-changer. The problem is that we don't know right now what constitutes a 'healthy' microbiome and are only just beginning to scratch the surface in understanding how different biopesticides and biostimulants affect microbial populations to benefit the plant. We know that some microbes can have a tremendous impact on plant growth and health, but do they work in all settings? It's fascinating to tease apart the important parts, understand the microbiome better and to discover how to improve productivity and sustainability."

Here's an interesting anecdote. The pine beetle has devastated forest stands in



Dr. Michael Brownbridge is pictured with researcher Taro Saito in Vineland's pre-commercial greenhouse. Photo courtesy of Vineland.

western Canada. But when foresters tried to replant, in many cases the new trees didn't flourish. When soil samples were taken, researchers found that the soil contained a limited microbial community and the microbes that seedlings needed – commonly associated with so-called healthy soils – were not present. Plants require microbes to survive and thrive.

There's no guidebook yet on the use of biopesticides and biostimulants. But one of the most important aspects is to reframe the questions of whether they work and how they are evaluated.

In Brownbridge's opinion, success will depend on how and where they are used.

Editor's note: Dr. Michael Brownbridge will be speaking about biopesticides and biostimulants at the Canadian Greenhouse Conference in Niagara Falls. Catch his presentation on October 3, 9:30 am in Room 207/208. For the full agenda, go to: www.canadian-greenhouseconference.com





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