Breakthrough ag technology from MSU heads to EPA for approval

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Certis USA, a top manufacturer of biological pesticides, announced today that a disease-fighting bacterium discovered at Montana State University is now heading for regulatory review in the U.S. and Canada, a final hurdle to bringing the technology to market.

Certis USA's disease-fighting agent BmJ WG was discovered and named "*Bacillus mycoides* isolate J" by Barry Jacobsen, professor of plant sciences and plant pathology in MSU's College of Agriculture. After isolating BmJ from healthy leaves in an otherwise disease-ridden sugar beet field in 1994, Jacobsen has shown that this naturally occurring bacterium is beneficial in fighting bacterial, viral and fungal diseases in a variety of crops. It works by activating the plants' own immune defenses in a phenomenon known as systemic acquired resistance, or SAR.

"This is a technology that could save farmers around the world millions of dollars by providing disease control when used alone, reducing fungicide use when used in combination with fungicides and by helping to manage fungicide-resistance outbreaks," Jacobsen said.

Certis USA's move to put BmJ up for review by the Environmental Protection Agency, as well as the California Department of Pesticide Registration and the Pest Management Regulatory Agency of Health Canada, comes after two years of intensive field trials coordinated by Certis USA against diseases in key crops.

Jacobsen said the trials included his research group at MSU, as well as

scientists from universities and private groups across the country.

"I've been extremely impressed with the team that Certis has working on BmJ," Jacobsen said of testing efforts that have been ongoing in North Carolina, Georgia, Florida, Texas, California, Idaho and Washington. "These are top people in the (plant pathology) field, and they have shown efficacy data that confirms how well it's working. I knew it worked but I didn't know it worked on some of the things they tested it on."

Building on data from earlier trials by Jacobsen and collaborators targeting Cercospora leaf spot of sugar beets, potato virus Y and other important crop diseases, the Certis USA field development team found that BmJ is able to control gummy stem blight on cucurbits (family that includes watermelons, pumpkins and cucumbers), downy mildew on leafy vegetables, late and early blights of potatoes and bacterial leaf spot diseases of tomatoes and peppers.

Michael Dimock, director of field development at Certis USA, said, based on the levels of disease control attained in trials, the proposed labeling includes uses on potatoes, sugar beets, cucurbits, fruiting vegetables, lettuce, spinach and pecans.

"Over the last two years, we have expanded our focus and the result is that we've put in a label proposal to the EPA that considers a much wider array of crops because we've seen a broader spectrum of efficacy than we'd ever seen before," Dimock said.

BmJ's potential to tap an international market across a wide swath of the agricultural spectrum represents a major win for the land-grant university system's goal of bringing technology to the citizens, said Rebecca Mahurin, director of MSU's Office of Technology Transfer.

After investigating a Sidney sugar beet field overrun with Cercospora

leaf spot 20 years ago, Jacobsen and his collaborators isolated more than 300 Bacillus bacteria found on the healthy leaves. They were looking for one that was special. Jacobsen found it in Bacillus mycoides isolate J (the J marked its place in the team's A-B-C list of different Bacillus mycoides bacteria). Jacobsen and his team spent more than a decade examining its disease-fighting effects on sugar beets and potatoes. Along the way, in 2003, BmJ was licensed to Montana Microbial Products. In 2012, because of its expertise with biopesticides, Certis USA was selected in a sublicensing agreement to manufacture and market BmJ.

"We are so pleased with the news that BmJ is entering this phase," Mahurin said. "Getting to this final step of bringing this MSU technology to farmers in Montana and around the world represents quite a huge investment of time and resources for Certis. It also validates two decades that Dr. Jacobsen has dedicated to BmJ, as well as the invaluable contributions from Cliff Bradley and Montana Microbial Products."

In all, MSU holds seven patents related to BmJ.

Jacobsen describes plants' reaction to an initial detection of potentially pathogenic microorganisms as a "switching on" of resistance genes, causing a cascade of metabolic responses to limit infection and disease development.

In the case of BmJ, something amazing happens – it switches on one particular gene, the NPR1 gene, which is found in most plants. When the NPR1 gene is turned on, it sets in motion a whole range of defenses for the plant, a prime example of induced resistance. (See a video describing the BmJ story).

"Within five minutes of that bacillus spore being on the plant leaf, the plant knows it's there and it starts its (SAR) defense reactions," Jacobsen said. "It reacts by producing hydrogen peroxide and some other things

and this thickens cell walls and makes it more difficult for a pathogen to infect. Within a day, it starts to produce enzymes that attack fungi and bacteria. And it is very effective on some viruses as well."

While some microbial biofungicides have been reported to also have moderate SAR activity, BmJ is unique in that it works entirely as a microbial SAR activator with no direct antagonistic effect on plant pathogens. BmJ induces the same genetic resistance pathway as the class of chemical SAR inducers known as benzothiadiazoles, but for longer periods and with lower risk of phytotoxicity.

These characteristics make BmJ a valuable tool for use in fungicide-resistance management programs, Jacobsen said.

"Because BmJ acts so differently from most fungicides, with no direct action against a specific pathogen target site, it has great potential for use in disease management programs designed to reduce the risk and consequences of fungicide resistance," Dimock said. "In fact, Dr. Jacobsen's fieldwork over the past decade has already demonstrated the utility of BmJ in programs for management of fungicide-resistant Cercospora leaf spot in sugar beets. We expect to see similar benefits in other crops where resistance to conventional fungicides presents a serious challenge."

Certis USA has found BmJ to be compatible with a wide range of pesticides, including triazole, EDBC and QoI class fungicides and a wide range of insecticides, making it ideal for use in integrated pest management programs. The Certis USA team found disease control to be equal to commercial standards when BmJ is used in combination with low rates of fungicides or in alternating programs where BmJ replaces half the fungicide used in fungicide-alone programs.

Certis USA expects that BmJ will be approved by the Organic Materials

Review Institute and EPA for use on organic crops, Dimock said.

In more recent MSU research, Jacobsen and his group have shown an application of BmJ prior to harvest can offer some control of post-harvest decay of sugarbeets and potatoes.

Jacobsen said it could also prove invaluable for treating an array of post-harvest diseases in berries and other high-value products that currently need treatment with fungicide to prevent molding during storage.

"I think it will be a very exciting product for those growers, both traditional and organic farmers, who want an effective biological control that works for a range of crops," Jacobsen said. "This will give them a tool unlike anything they've ever had."

Provided by Montana State University