For Cheaper Bioinsecticides

Factory and field technologies, advancing together, may put a friendly fungus in the forefront of a new bioinsecticide service industry.

Growers of high-value horticultural and vegetable crops could be the first to benefit from Agricultural Research Service work with industry to mobilize the microbe *Paecilomyces fumosoroseus* against silverleaf and greenhouse whiteflies.

Technologies for mass-culturing *P. fumosoroseus* may later be adapted to different fungi suited to protecting turf grasses from insects. Companies that provide care for lawns and golf courses could then apply more environmentally friendly pest controls. Such services may have special appeal to families with young children or pets.

"The idea is to produce and dry fungi in a factory and parcel them to portable fermentors at field sites where they can be rejuvenated, multiplied, and applied through spray or irrigation systems," says Mark A. Jackson. He is a microbiologist at ARS' National Center for Agricultural Utilization Research (NCAUR) in Peoria, Illinois.

The scientists use a portable fermentor patented by Eco Soil Systems, Inc., of San Diego, California, under a 3-year cooperative research and development agreement begun last summer. Eco Soil technicians now use the fermentation system, called BioJect, to produce fresh batches of nitrogen-fixing bacteria for application through irrigation sprinklers to make golf course grass greener and healthier.

In the beginning stages of his research on *P. fumosoroseus*, Jackson modified deep-tank fermentation technology developed by NCAUR a half century ago. The technology originally launched an arsenal of antibiotics against human disease, beginning with penicillin. Since applying for a patent about 3 years ago, Jackson and his colleagues have steadily improved mass spore production of *P. fumosoroseus*, doubling the number of spores produced in a tank and cutting fermentation time from 3 days to less than 2. Along the way, they developed fermentation mixtures that are more economical than the precisely defined recipes used earlier.

"Our main goal has been to produce spores that will do their job dependably in the greenhouse and in the field," says Jackson.

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Microbiologist Mark Jackson checks dried spore preparations of the fungus *Paecilomyces fumosoroseus* after removal from a small, commercial-scale freeze-dryer.

For factory-produced fungi to become commercially viable, even for use in portable fermentors, large and predictable numbers of healthy spores must be produced months in advance. The spores should survive freeze-drying and long-term storage. In recent laboratory studies, the scientists found about 75 percent of freeze-dried spores remained alive after 5 months of storage.

To further lower bioinsecticide costs, scientists are defining conditions that allow the fungus to multiply rapidly in portable fermentors. After small packages of well-maintained, freeze-dried spores are mixed with nutrients in the fermentors, the spores spring vigorously from their Rip Van Winkle state and multiply 100- to 1,000-fold. These fresh, active spores produced on site can be sprayed directly on the crop to infect and kill whiteflies.

As research with Eco Soil Systems progresses, Jackson plans to inoculate BioJect fermentors at several ARS locations and commercial field sites. His research on control of whiteflies with *P. fumosoroseus* also involves collaboration with other industrial and academic scientists in Mexico, Spain, and the United States.—By **Ben Hardin,** ARS.

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