Plant Protection Today: USDA Scientists Study Steam Heat as a Potential Treatment for Fresh Commodities

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(Photo Cover: Biological Scientist Xikui Wei sorts through cherries collected from USDA’s Agricultural Research Service experimental farm in Wapato, WA, for steam

heat treatment efficacy on Western cherry fruit fly and the treatment's impact on fruit quality.)

An Agriculture Balancing Act: Eliminating Target Pests without Damaging Fruits

By Sharon Lucik

Early in 2020, two colleagues in the Treatment and Inspection Methods Laboratory (TIML) of USDA's Plant Protection and Quarantine (PPQ) program began researching vacuum steam as an alternative for methyl bromide treatment for fresh fruits. Encouraged by the initial results, the pair forged ahead to problem-solve and innovate. Today PPQ is closing the gap on steam's potential as an environmentally friendly plant health (phytosanitary) solution to eliminate potential pests.

"We are focused mainly on steam heat trials," said TIML's Biological Scientists Xikui Wei. "Vacuum steam is effective and can be useful for certain durable commodities, such as logs, tiles, or grain, but we determined it may not be a practical treatment for large volumes of fresh produce. So far, our trials show that steam alone can be an effective treatment especially for internal pests like fruit flies in citrus, mango, guava, apple and cherry."

In Lockport, NY, Biological Science Lab Tech Luis Bradshaw collects fruit fly-infested wild honeysuckle berries—a European Cherry fruit fly host—to evaluate the efficacy of steam heat treatment on the pest.

It’s been a busy year for Wei and Biological Science Laboratory Technician Luis Bradshaw. They have crisscrossed the country conducting steam heat field trials in quarantine areas on three fruit fly species and a maggot.

In February they teamed up with PPQ’s Insect Management and Molecular Diagnostic Laboratory staff in south Texas to evaluate steam heat on citrus varieties and

determine lethal heat temperatures for Mexican fruit fly. The following month, they collaborated with USDA’s Agricultural Research Service scientists in Florida to assess grapefruit quality (post treatment), including visual appearance, taste, and smell, as well as marketability. In July, Wei and Bradshaw spent a week in Niagara County, New York, running tests on European cherry fruit fly. They also traveled to Washington state three times during fruit harvest seasons to evaluate treatment effects on fruit quality and the Western cherry fruit fly and apple maggot.

Given what they’ve learned, Wei is optimistic that steam heat could eventually become an acceptable treatment for certain fresh commodities, and scaled up for commercial use. He admits however, more research and challenges are ahead. His ultimate goal is to establish generic steam heat treatment schedules that retain a commodity’s integrity—such as apples, cherries, mangoes, oranges, grapefruit, etc.—and completely eliminate the target pests.

“Next year we have plans to make available a medium-sized steam heat treatment chamber so we can demonstrate to industry the treatment’s feasibility and scalability,” Wei explained. “The work of retrofitting a 20-foot sea container is underway to create a chamber large enough to hold three to four typical fruit bins for treatment. Our prototype will include an automated steam injection and circulation system to ensure that the steam is uniformly distributed throughout the chamber and reaches each fruit. This is a big step and moves our research to the next level.”

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