People & Places

Keeping apples fresh in storage

Jim Mattheis develops a game changing protocol for industry

By DAN WHEAT
Capital Press

Dan Wheat/Capital Press

Jim Mattheis, plant physiologist at the USDA Agriculture Research Service Tree Fruit Research Laboratory in Wenatchee, Wash., removes a sample of ethylene gas from the core of an apple. Over 20 years, Mattheis has developed the use of a synthetic molecule that inhibits ethylene to keep apples fresh longer.

WENATCHEE, Wash. — When Jim Mattheis was a boy in Lennox, S.D., he was curious about his friend's family's orchard: It didn't produce any apples.

It wasn't a commercial orchard. It was just a small, home orchard that had been neglected for years. The trees hadn't been pruned or sprayed. Spring frosts took their toll. Finding an apple was a novelty.

The orchard didn't bear much fruit but it did spawn an interest in horticulture in young Mattheis. Half a century later, Mattheis, now 59, is regarded as a transformative innovator by the apple industry.

As a plant physiologist and research leader at the USDA Agriculture Research Service Tree Fruit Research Laboratory, Mattheis has been the key figure in the testing and development of the synthetic molecule 1-methylcyclopropene — also called 1-MCP — which slows the ripening of apples to keep them fresher longer in storage. Industry packers and shippers worldwide have used it for 12 years, and Mattheis keeps refining best practices for new technologies and new apple varieties.

Paradigm shift

Extending the quality and shelf life of apples by using 1-MCP has represented a "paradigm shift" as significant to the industry as the development of controlled-atmosphere storage in the 1960s, Jim McFerson, director of the Washington State University Tree Fruit Research and Extension Center, has said.

No one can really pinpoint how much, but it's safe to say it's added millions of dollars in grower returns since widespread usage began in 2004. AgroFresh Inc. of Spring House, Pa., released it commercially as SmartFresh in 2002.

"Jim and his program team have not only been world leaders in developing robust approaches to using SmartFresh technology, but have consistently kept our Pacific Northwest tree fruit industry on the cutting edge of technological innovations in fruit handling and storage that enhance our ability to deliver the consumer a consistently superior eating experience," McFerson said.

As the laboratory's leader for 14 years, Mattheis has guided it to a "pre-eminent position in tree fruit physiology and soilborne diseases," he said.

Mattheis works well with the industry and the "industry would not be the same without his work," McFerson said.

Mattheis oversees four other scientists and a support staff of 32 graduate students, post doctoral researchers and visiting scientists.

Roots of research

"1-MCP is a product of a really long period of fundamental plant science research that started in the 1960s," Mattheis said.

Ed Sisler, a biochemist at North Carolina State University, began studying how growth and development are regulated in plants. He was interested in ethylene, a natural compound produced by plants, that causes fruit maturity and ripening. It's often produced as a protection in response to stress such as that caused by a wound.

"He was testing a lot of different compounds that had some sort of similarity to ethylene to see if he could promote or block responses to ethylene," Mattheis said.

Sisler and his colleague, Sylvia Blankenship, a horticulturist at NC State, identified 1-MCP as an inhibitor of various ethylene responses in plants.

Mattheis had spent his first 10 years at the ARS Tree Fruit Research Laboratory in Wenatchee developing controlled-atmosphere storage regimens for new apple varieties such as Gala, Fuji and Braeburn. He was interested in postharvest environmental factors impacting apple aroma. He determined that ethylene is important to aroma and was interested in the NC State findings.

"Sylvia had been working in apples so we were both interested in studying 1-MCP with apples and collaborated on work beginning in March 1997," Mattheis said.

Xuetong Fan, a post-doctoral scientist on Mattheis' staff, did most of the laboratory work. Mattheis and Blankenship published a joint paper on their findings in 1999 — the first regarding 1-MCP and apples.

What 1-MCP does

SmartFresh is applied as a non-toxic gas shortly after apples enter controlled-atmosphere storage, biodegrades and is gone shortly after application. It is highly effective at low concentrations.

Treatment maintains apple acids, retaining flavor, firmness and freshness. A residual effect of delayed ripening can last several weeks after fruit is taken from storage and shipped to retailers.

Studies of apples in grocery stores in 2007 by Eugene Kupferman, a postharvest specialist at the WSU Tree Fruit Research and Extension Center, showed SmartFresh actually increases the firmness of apples during the sales season.

1-MCP is also effective in preventing superficial scald, which is a browning of apple skin. By delaying ripening, 1-MCP also delays several internal browning disorders related to ripening such as core browning in Granny Smith apples, Mattheis said.

In the last several years, a field formulation of SmartFresh has been used in orchards to manage harvest timing by delaying it and to prevent premature apple drop.

"It prevents premature drop, slows maturation and can be applied close to harvest. Other materials only prevent drop without slowing maturation," Mattheis said.

On the downside, 1-MCP can lengthen the amount of time fruit is susceptible to carbon dioxide injury such as skin and internal browning and rough skin. To reduce that threat, carbon dioxide can be aggressively removed from storage atmosphere and controlled-atmosphere storage can be delayed after 1-MCP treatment. Delay of 1-MCP is a strategy for some varieties.

1-MCP does not meet requirements for organic fruit, which relies on low oxygen concentrations in controlled-atmosphere for best storage.

Ongoing research

In recent years, packers and shippers have begun using ozone to combat bacteria and external decay on fruit in storage. Depending on the concentration, ozone can inactivate ethylene and slow ripening. It can be used with 1-MCP or in place of it.

Mattheis is in his 19th year of 1-MCP research. He is the main scientist in Washington working on apple storage regimens. He re-tweaks those regimens, including use of 1-MCP, for various apple varieties to fit new technologies.

An example is making the regimen for Honeycrisp fit with a relatively new technology that measures fruit response to controlled-atmosphere storage.

"It used to be a warehouse would impose (controlled atmosphere) and hope it works. Now there are several ways, two in real-time, to measure response to low oxygen in particular," he said.

Six years ago, his regimen to lengthen Honeycrisp storage was to hold the fruit for one week after harvest at 50 degrees and then drop it to 36 degrees while keeping carbon dioxide at 1 percent or less and oxygen at 2 percent. That enabled storage for nine months.

Three years ago, Mattheis found that if Honeycrisp is treated with 1-MCP at 50 degrees it reduces bitter pit but if controlled atmosphere is turned on bitter pit is reduced even more.

That hadn't been done because fruit tends to have more problems with low oxygen the higher the temperature is. To assess whether Honeycrisp has a problem with low oxygen at 50 degrees, Mattheis will be using a pulse of light to measure chlorophyll fluorescence in fruit skin. If it's too low the oxygen level needs to be raised.

The research goes on. It has been fulfilling.

"When I went to graduate school and learned about fruit development, maturation and ripening, this wasn't something I anticipated," Mattheis said. "You can do a lot of great science and no one really benefits. But there's been a great benefit from 1-MCP."

Western Innovator

Jim Mattheis

Age: 59

Born: Sioux Falls, S.D.

Raised: Lennox, S.D.

Family: Wife, Darcee, is a social worker. Their son, Carl, 21, is training to become an aircraft mechanic.

Education: Bachelor's degree in biology, Augustana College, Sioux Falls, S.D., 1979; master's degree in public health, University of Minnesota, 1981; doctorate in horticulture, Washington State University, 1987.

Occupation, work history: Plant physiologist, USDA Agriculture Research Service Tree Fruit Research Laboratory, Wenatchee, Wash., since 1988; laboratory research leader since 2002.

Miss Oregon Teen USA at home on the farm

By JANAE SARGENT
Capital Press

Janae Sargent/Capital Press

Mikaela Bruer shows off her goat at her family's property in Dallas, Ore.

Mikaela Bruer says she is using her title as Miss Oregon Teen USA to educate and inspire young people about agriculture.

The 17-year-old from Dallas, Ore., competed in the Miss Teen USA pageant in Las Vegas, Nev., on July 29-30 where she placed 16th.

Though most contestants returned home and began winding down from the chaos of the national pageant, Bruer started prepping to show her goats, dairy cows, market steer and alpacas at the Polk County Fair on Aug. 11.

Bruer lives on her family property that was started by her great-great-grandfather. Her dream is to study veterinary medicine at Cornell University and become a large-animal veterinarian that specializes in dairy animals.

Bruer said she has a deep love for animals and pageantry and she loves being an example of how the two can go together.

In addition to being Miss Oregon Teen USA and competing in pageants, Bruer is in 4-H, FFA and is a model and a competitive golfer and archer. She maintains above a 4.0 grade-point average.

She said she uses her position in the spotlight to break down stereotypes about the agriculture industry and pageantry and show how the things she does overlap.

"Pageantry and agriculture both have stereotypes that go with them," Bruer said. "I want to show people no matter which side of the spectrum you're on, they can go together."

Bruer got her start in 4-H when she was 9 years old, following her mother, Denise McCormick, who raised sheep when growing up.

She started with horticulture and cooking but quickly fell in love with animals and got her first Norwegian dwarf goats when she was 12.

Her start in pageants was less conventional. McCormick said she started Bruer in pageants when she was 6 to encourage her out of her shell and get used to public speaking and making connections.

"I was painfully shy when I was a kid," McCormick said. "I just wanted to start her young and teach her to be more outgoing."

Bruer started going to one pageant a year but quickly fell in love with pageantry and began traveling the world to compete and model.

Calendar

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Saturday and Sunday Aug. 13-14

Harvest Fest, 10 a.m.-4 p.m. Yamhill Valley Heritage Center, 11275 SW Durham Lane, McMinnville, Ore. Threshing, binding and baling oats using vintage farm equipment, horses and mules; "Parade of Power" tractor parade at 1 p.m. each day; pioneer kids' activities, pedal tractors and petting animals. $5 admission, kids under 12 are free. www.yamhillcountyhistory.org

Oregon Cannabis Growers Fair, 10 a.m.-4 p.m., Oregon State Fairgrounds, 2330 17th St. NE, Salem. Over age 21 only. https://oregoncannabisgrowersfair.com/

Tuesday, Aug. 16

Oregon Soil and Water Commission Meeting, 8:30 a.m.-12:30 p.m. Hilton Garden Inn, 3528 Gateway St., Springfield, Ore. www.oregon.gov/ODA/programs/NaturalResources/SWCD/Pages/SWCC.aspx

Tuesday-Thursday Aug. 16-18

Practical Food Safety & HACCP Workshop. This is a comprehensive, three-day workshop, designed for those individuals responsible for implementing and managing a HACCP system in a food manufacturing facility. Participants who pass a final test will receive a certificate of completion. Idaho Water Center, 322 E. Front St., Boise, Idaho. Cost: $650. www.techhelp.org/events/273/practical-food-safety-haccp-workshop-august-16-18-in-boise/

Friday, Aug. 19

8th Annual Friends of Oregon Agriculture Golf Tournament. This annual fund-raiser for Oregon Aglink's Adopt-a-Farmer program includes the popular golf ball drop. Chehalem Glenn Golf Course, Newberg, Ore. www.aglink.org

Western Idaho Fair, 5610 Glenwood, Boise, 208-287-5650, http://sharemyfair.com/

Saturday, Aug. 20

Oregon Aglink Barn Dance, 6:30-10:30 p.m. Celebrating Oregon Aglink's 50th anniversary. Victor Point Farms, Silverton, Ore. Cost: $50 www.aglink.org

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Sunday, Aug. 21

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Monday, Aug. 22

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