A New World of Watermelon

ARS develops low-sugar melons, finds mini-fruit rich in key nutrients.

There's a lot happening in the world of watermelons. Just ask researchers at ARS's South Central Agricultural Research Laboratory in Lane, Oklahoma.

For starters, plant geneticist Angela Davis is developing low-sugar watermelons. These melons, which still maintain high lycopene levels, would be welcomed by diabetics.

Meanwhile, plant physiologist Penelope Perkins-Veazie has followed up previous work—in which she confirmed watermelon as a high-lycopene food (See "Watermelon Packs a Powerful Lycopene Punch," *Agricultural Research,* June 2002)—by finding that lycopene and beta-carotene are abundant in mini-watermelons, a niche product that's recently seen a surge in popularity.

Lycopene is a red pigment that gives watermelons and tomatoes their color. Studies have linked it to reduced incidence of certain cancer types and lower heart-attack risk. Beta-carotene, which is also found in regular watermelons, converts in the body to vitamin A, which promotes clear vision, bone growth, and healthy reproduction.

The researchers' latest studies were simplified by a technique they developed with Lane biochemist Wayne Fish, allowing rapid determination of watermelon's lycopene content.

Davis says that the low-sugar watermelons she's developed are "just like regular watermelons. They're crisp and refreshing, just like a melon should be." And she says people can use artificial sweeteners if they wish to fully duplicate the taste found in regular watermelon.

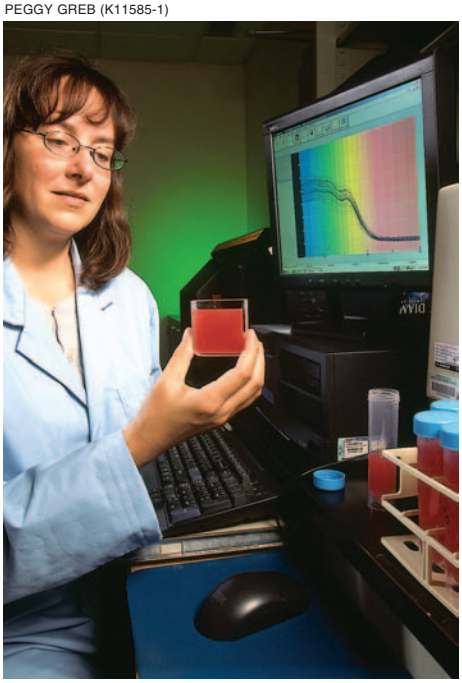
She says the market potential for these fruits is substantial "because many consumers view excess simple sugars as bad for them." Oklahoma State University food specialist Barbara Brown agrees. "They would be particularly attractive to diabetics and people on low-carb diets," she says. "These melons would suit these groups very, very nicely."

Davis was inspired to develop the melons by concerns about diabetes rates and by the results of watermelon breeding over the past few decades. "Conventional breeding techniques have increased the sugar content—what we call 'total soluble solids' (TSS)—in watermelon up to 14 percent," from around 10 percent, Davis says. "This has made watermelons off limits to people concerned about dietary sugar intake."

PEGGY GREB (K11589-1)

Before analyzing it in the lab, technician Shelia Magby (left) and plant physiologist Penelope Perkins-Veazie examine a freshly sliced mini-watermelon.

PEGGY GREB (K11585-1)



Watermelon's red color comes from lycopene. Plant geneticist Angela Davis measures lycopene content of puree from a new, low-sugar watermelon.

The Redder the Better

Previous independent research has associated sugar content in watermelons with flesh color: the redder the hue, the higher the TSS level. "We were interested in determining whether there's a critical TSS concentration necessary for color development in watermelon flesh," says Davis.

She says red pigment is important from a marketing standpoint. "People like to eat red watermelon. They associate a pale-pink color with unripe melon."

Davis, working with Perkins-Veazie and food technologist Julie Collins, screened for sugar content in lines of watermelon, *Citrullus lanatus,* provided by ARS's Southern Regional Plant Introduction Station's germplasm bank. The station is run by ARS's Plant Genetic Resources Conservation Unit in Griffin, Georgia, in cooperation with the Southern Agricultural Experiment Stations.

The team grouped melons into "red" and "pink" categories and compared the TSS values to color development. Among their findings: of 77 red watermelons, 7 had a TSS of less than 6 percent, which Davis considers low. Of 80 pink melons tested, 33 had a TSS below 6 percent.

"This shows that pigment production can occur without high TSS production,"

she says. "We even found red pigmented fruit with a TSS content as low as 3.1 percent."

Next was development of a commercially acceptable, low-sugar, high-pigment watermelon that consistently produces flavorful fruit. "We have a line that produces crisp, red-fleshed watermelon with a TSS content of around 5 percent," she says. "But it's not ready for commercial production, since it does not yet express consistent flesh color. Further selection is required."

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Technician Anthony Dillard pollinates watermelon blooms for low-sugar melon crosses.

Mini-Melons for Your Lunch Bag

Meanwhile, Perkins-Veazie investigated the nutritional aspects of mini-watermelons, which are about 6 inches in diameter and weigh between 3 and 7 pounds. They are seedless, have a thin rind, and offer uniform flavor throughout. They've been commercially available for about 2 years.

"They're a new option," she says. "You don't have to slice a watermelon up anymore to carry it with you. You can take one along for lunch and slice it open there."

Her team tested 15 lines of mini-watermelons already on the market and discovered that the fruits are chock-full of lycopene and beta-carotene. Average lycopene concentrations of the 15 lines ranged from 6,700 to 9,600 micrograms per 100 grams (µg/100 g), with several varieties scoring higher lycopene levels than previously reported for conventional large seeded and seedless watermelons. Those ranged from 3,700 to 6,900 µg/100g.

"Also, two varieties were unusually high in beta-carotene, with averages of 1,100 to 1,400 µg/100 g," says Perkins-Veazie. "Full-sized seeded melons usually have about 300 µg/100 g."

She stresses that all mini-melon lines are the result of natural breeding and that genetics is probably the biggest factor in her results. "It wouldn't be right to say that mini-melons just naturally have higher lycopene and beta carotene contents than larger melons. But we've shown that the mini-melons on the market are high in these important nutrients, and that's just another characteristic that consumers will like."

Future research will focus on methods of extracting lycopene from watermelons for use in dietary supplements or food colorants. "With all these exciting changes, watermelon is not just for picnics anymore," she says.

Sam Pair, the laboratory's research leader, agrees. "I have in my office an experiment station bulletin more than 100 years old that states watermelon has no other use than as a sweet treat. That concept has been thoroughly dispelled. We are only beginning to scratch the surface regarding the health benefits and potential value-added products watermelon can provide."—By **Luis Pons,** ARS.

This research is part of Plant, Microbial, and Insect Genetic Resources, Genomics, and Genetic Improvement (#301) and Quality and Utilization of Agricultural Products (#306), two ARS National Programs described on the World Wide Web at www.nps.ars.usda.gov.

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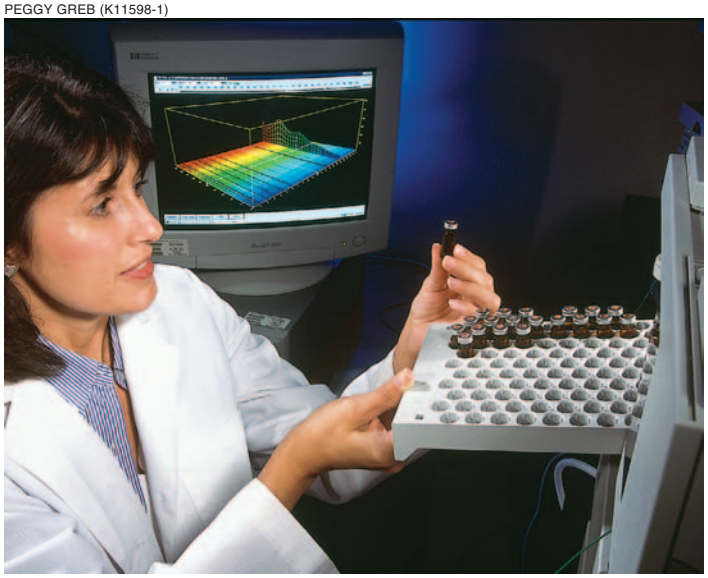

Food technologist Julie Collins loads samples of extracted carotenoids from watermelon for high-performance liquid chromatography analysis.