Yes, Really . . . A Store-Bought Tomato With *Vine-Ripened* Taste!

Hormones! They're important to the human body's growth and metabolism. For similar reasons, they're also vital to plants.

Of the five major plant hormones, auxin has been known the longest and is probably the most important.

Auxin causes a tomato to grow and ripen, according to ARS plant physiologist Jerry D. Cohen. And if scientists can learn more about this plant growth hormone, the result could be a store-bought tomato that tastes home grown. Cohen is working toward that goal at the ARS Horticultural Crops Quality Laboratory in Beltsville, Maryland.

"If we can determine how auxin is made in a plant, then we can change the concentration, or level. We also need to know how much is made and how it is broken down," he says.

During ripening, auxin degrades to low levels, often resulting in overripening. "Since we want to delay ripening," Cohen says, "we want to increase the levels at this stage of growth. If we raise the auxin levels, we slow down ripening and increase shelf life."

Growers now pick tomatoes when they're still green to ensure that they'll ship well. If tomatoes were picked fully ripened, they'd deteriorate before reaching the grocery shelf. Tomatoes from the produce bin in supermarkets are often hard and tasteless simply because they were picked green, before being given time to ripen on the vine.

Cohen says that scientists have been working with auxin for more than 120 years. One problem, he says, is that when researchers changed auxin levels, the changes were expressed throughout the plant. Scientists would like to control auxin production so it can be introduced into particular, targeted tissues.

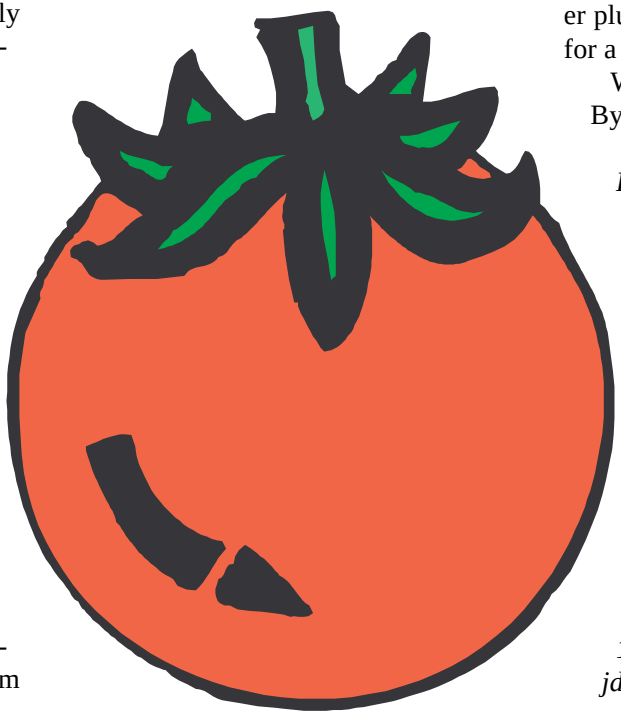
To change auxin levels in fruit, it was important to first find out how plants make it. Earlier studies suggested that this plant hormone was made from tryptophan, an amino acid.

Cohen and colleagues showed that plants that don't make tryptophan can still make auxin. Until now, auxin production was studied only inside whole plants or cells. But Cohen has reproduced this hormone outside the cell, where it can be studied in greater detail.

Changing From the Inside, Out

Cohen and associate Mridula Iyer, working with plant molecular biologist Janet P. Slovin of the ARS Climate Stress Laboratory in Beltsville, are looking at genetic methods to alter auxin levels. They inserted a backwards copy of *iaglu*—a gene from corn—into a tomato. The purpose was to turn this gene off in the tomato. Because the backward gene was put in with a fruit-specific promoter—a piece of DNA placed in front of the gene that controls when and where that gene will be "turned on"—the activity was changed only in the tomato fruit.

"We specifically changed the hormone levels in the fruit, but not in other parts of the plant," Cohen reports. "Tomatoes from this genetic research ripened more slowly, but not enough to make a major difference."



Future work is aimed at using a native tomato gene in the same way to alter the biosynthesis of auxin. Just as important is determining the plant's ability to destroy or break down the hormone when the fruit is in the very early, or "breaker," stage of ripening.

Cohen and colleagues discovered some other interesting aspects of the *iaglu* gene. Decreasing the gene's level of expression throughout receptor plants caused them to easily form large numbers of roots from cuttings and spurred rapid root growth in germinating seedlings.

This could significantly help in developing techniques for plants that are difficult to root from cuttings and increase the survival rate of seeds planted in dry soils.

"We also got seedless tomatoes from overexpressing the corn gene specifically in fruit," Cohen says. "Because it didn't happen every time, we're trying to determine if the cause is directly linked to the gene or is just a result of transforming the plant."

Cohen expects the auxin research to produce vine-ripened tomatoes with increased shelf life, better flavor, and enough firmness to last until the consumer plucks the fruit from the produce bin for a salad or sandwich.

When? "In about 3 years," he says.—By **Doris Stanley Lowe**, ARS.

This research is part of Improving Plant Biological and Molecular Processes, an ARS National Program described on the World Wide Web at http://www.nps.ars.usda.gov/programs/cppvs.htm.

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