Discovery may lead to new tomato varieties with vintage flavor and quality

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A new discovery could make more tomatoes taste like heirlooms, reports an international research team headed by a University of California, Davis, plant scientist.

The finding, which will be reported in the June 29 issue of the journal *Science*, has significant implications for the U.S. tomato industry, which annually harvests more than 15 million tons of the fruit for processing and fresh-market sales.

"This information about the gene responsible for the trait in wild and traditional varieties provides a strategy to recapture quality characteristics that had been unknowingly bred out of modern cultivated tomatoes," said Ann Powell, a biochemist in UC Davis' Department of Plant Sciences and one of the lead authors of the study.

"Now that we know that some of the qualities that people value in heirloom tomatoes can be made available in other types of tomatoes, farmers can have access to more varieties of tomatoes that produce well and also have desirable color and flavor traits," she said.

For decades, plant breeders in the tomato industry have selected varieties that are uniformly light green before they ripen, in order to produce tomatoes that can be harvested at the same time.

However, this characteristic is accompanied by an unintended reduction in sugars that compromises the flavor of the fresh fruit and its

desirability for processing.

Powell's UC Davis research team began studying the genes influencing tomato fruit development and ripening after spending two summers screening tomato plants for transcription factors that might play a role in both fruit color and quality. Transcription factors are proteins that regulate genes, or turn them on and off. These factors themselves are manufactured or expressed by genes.

The UC Davis researchers were particularly interested in tomatoes they observed in the field that were unusually dark green before they ripened.

Partnering with researchers at Cornell University and in Spain, who were mapping regions of the tomato genome, the scientists discovered two transcription factors, called GLK1 and GLK2, that control the development of chloroplasts. Chloroplasts are the structures in the plant cells that enable plants to photosynthesize, converting the energy of sunlight into sugars and other compounds that influence flavor and color.

The researchers scoured a collection of mutant and wild species of tomatoes at UC Davis established at UC Davis by the late Professor Charles Rick beginning in the 1950s. They discovered that dark green tomatoes that naturally express GLK2 produced ripe fruit with increased levels of sugars or soluble solids, important for processing tomatoes, as well as higher levels of the health-promoting compound lycopene.

"Nature presents numerous important genes and their variants, like uniform ripening, that breeders employ to facilitate the needs of growers, processors and consumers," said Jim Giovannoni, a USDA plant molecular biologist with the Boyce Thompson Institute at Cornell University. "Understanding the genes responsible for these characteristics facilitates the challenging process of breeding crops that meet the needs of all components of the food-supply chain."

More information: The journal article, "Uniform ripening Encodes a Golden 2-like Transcription Factor Regulating Tomato Fruit Chloroplast Development, " appears in *Science*, June 29, 2012.

Provided by UC Davis