Keys to Cotton Fiber Strength

Something inside a cotton fiber cell makes it grow longer without dividing, improving the fiber's strength. By finding out what that is and how it works, plant physiologist Carolyn Zeiher hopes to find ways to develop and grow better quality cotton.

"The cotton industry today demands more from the cotton fiber because spinning systems have improved and production speeds have increased," Zeiher said. "The textile industry requires high quality fiber in terms of length, strength and uniformity."

Working in the Department of Plant Sciences at the University of Arizona, Zeiher analyzes physiological and biochemical mechanisms in cotton fibers to see how they affect cotton quantity and quality.

She believes that understanding the biological factors that regulate cotton fiber properties will be of immense practical importance in developing future plant breeding and genetic engineering strategies for cotton.

"In a mature boll, each fiber attached to the seed is a single cell," Zeiher said. "I'm trying to determine the factors involved in cell elongation so I can explore how environmental conditions affect the length and strength of the fiber."

The research focuses on the enzymatic actions of PEP carboxylase in producing malate, an organic compound. As malate accumulates in the fiber cell, it causes the cell to lengthen. Because the complexities of the process are not well understood, Zeiher is working to assemble some baseline data.

"We're going after the PEP carboxylase gene, and once we have that we can play some tricks," Zeiher said. "If we reduce the PEP carboxylase protein in the fiber cell, will the fiber still elongate? Will it do it without malate? Will it overproduce sugars to compensate, or is malate essential?"

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"Ultimately, once I've got all the biological tools, we can work on environmental interaction," Zeiher said. "I'm most interested in heat and water stress in Arizona, and their effects on fiber development."

Potted cotton plants used in the project occupy one greenhouse and half of another on the UA campus. Zeiher will tag flowers when they open and harvest bolls at different stages of fiber development to examine the level of PEP carboxylase activity and its effect within the fiber cells.

As Zeiher's work progresses from the laboratory to the greenhouse and later to the field, she believes that eventually it will enrich both commercial cotton production and basic biological science. ❖

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