How cotton was born

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A coming together and genetic merging of an American plant with an African or Asian plant one or two million years ago produced the ancestor of the bush that now provides 90% of the world's commercial cotton. And although the resulting plant has been domesticated and changed genetically by breeding over thousands of year, it retains a genetic structure and capacity which is conducive to further modification.

These are some of the significant outcomes of the detailed studies of the cotton genome by Professor Jonathan Wendel and his colleagues at Iowa State University discussed at the XVIII International Botanical Congress.

"Our work on gene activity demonstrates an unequal contribution of the two genomes," Wendel says. "We are now exploring the unique breeding opportunity offered by the existence of multiple, parallel domestications of different wild cotton ancestors by aboriginal peoples in Africa-Asia and Central America."

High-yielding modern cotton plants, with their long, strong, fine and white cotton fibres –which are the elongated "hairs" on the surface of cotton seeds—were developed from shrubby ancestral forms that bore shorter, coarser, tan fibres. The researchers compared these two types of fibre using DNA microarray chips.

The comparison revealed activity differences in thousands of different genes during development, Wendel says. The results show the genes affected by human selection, which means those responsible for modern cotton.

Genome scientists can help cotton farmers by developing and breeding plants that require less water, he says. And, because cotton is a target for nasty bug infestations, many growers heavily douse their plants in pesticides that are dangerous to human and animal health. Plants bred or engineered with enhanced natural defence mechanisms may reduce the need for these chemicals and improve the environment.

Background information

Scientists have discovered that modern cotton differs from forms domesticated by early farmers in the timing and level of gene expression, or the process by which a gene's information is translated into a biological function. Their findings reveal the complex details of how cotton fibers were altered by thousands of years of farmers' selection for better crops.

Cotton is the most important fiber plant in the world and an important oil seed. Its production and downstream uses comprise a vital part of the US economy. The study informs us about the genes that provide modern cotton with its commercially important properties, thereby providing new avenues to pursue for further enhancement of the crop through breeding.

High-yielding modern cotton plants, with their long, strong, fine and white cotton fibers (actually elongated "hairs" on the surface of cotton seeds) were developed from shrubby ancestral forms that bore shorter, coarser, tan fibers. Researchers compared these two types of fiber, ancestral and descendant, using DNA microarray chips. The comparison revealed gene expression differences during fiber development for thousands of different genes. The results illuminate the genes affected by human selection, i.e., those responsible for modern cotton.

Everyone's favorite pair of jeans and jammies started out as bunch of single celled fibers growing on tiny cottonseeds. The cotton plant is a shrub that is native to tropical and subtropical climates around the world. The cotton fiber is a collection of single cells made of almost pure cellulose. These fibers' naturally springy structure gives them lots of strength, durability, and absorbency. When dried, they form flat, twisted, ribbon-like shapes perfect for spinning fine yarn and clothing you and all your friends.

Cotton evolved on almost every continent, but it took cotton from the opposite ends of the earth to create the plant we use today. A one-in-a-million chance meeting of an American plant with an African plant (or Asian, we're not sure!) produced the cotton ancestor that gives us 90% of the world's commercial cotton. Through the domestication process, breeders grew cotton plants with longer, stronger, softer and more numerous fibers. When the cotton genome is fully sequenced, scientists might figure out exactly which genes control traits like softness or strength.

Another way that genome scientists can help cotton farmers is by developing and breeding plants that require less water. Cotton is a thirsty crop, and as water resources get tighter around the world, economies that rely on it face difficulties and conflict. Cotton farming also brings environmental concerns. Because cotton is a target for nasty bug infestations, many growers heavily douse their plants in pesticides that are dangerous to human and animal health. Plants bred or engineered with enhanced natural defense mechanisms may reduce the need for these chemicals and improve the environment.

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