ARS Improves Yields in 100-Year-Old Experiment

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The 106th cotton crop grown on the Old Rotation—the world's oldest cotton experiment.

1896. McKinley beats Bryan to become president. The first modern Olympic games take place in Athens. George Burns is born. And Auburn University professor J.F. Duggar starts a cotton experiment near the Alabama campus to try to prove that sustainable cotton production could be achieved in the state if farmers used crop rotations that included legume cover crops in winter.

That experiment—known as the Old Rotation—is still going on today, but Auburn researchers, led by professor Charles Mitchell, the current curator of the experiment, decided to update it after its 100th anniversary celebration. The researchers were getting valuable information and good yields of cotton, but they thought they could get more out of the world's oldest continuous cotton plots and the third oldest of any crop experiment in the United States.

They asked for help from the Conservation Systems Research Team at the Soil Dynamics Laboratory, an Agricultural Research Service laboratory located on campus. With the changes ARS researchers made, record yields have since been noted.

Led by agronomist Wayne Reeves, the ARS team decided to use a form of conservation tillage with specialized deep tillage. This method alleviates soil compaction while maintaining crop residue cover on the soil. They coupled this with new herbicide-resistant varieties of cotton, corn, and soybean. With the new system, there was an average increase in cotton yield of 22 percent.

"We noticed dramatic results almost immediately; soil carbon and associated soil quality and productivity have increased more rapidly than we thought possible," Reeves says. A record 1,600 pounds of cotton lint per acre (more than 3.3 bales) was measured on one plot in 2001. The previous record (before no-till was introduced to the fields) was 1,490 pounds of cotton lint per acre.

Also, yields of corn increased 38 percent and wheat yields increased 81 percent when these crops were grown in rotation with cotton. A record corn yield of 236 bushels per acre was harvested from one plot in 1999, and record wheat yields were consecutively set in 1999, 2000, and 2001.

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Conservation tillage farming provides many economic and environmental benefits to the farmer. Since the soil is not touched after harvest until the next growing season, there is less erosion because of the residue left on the fields. Reeves stresses the need for crop residues in conservation tillage, especially in warmer regions. This residue traps moisture and nutrients in the soil and suppresses weeds, often reducing the amount of chemicals the farmer must use.

Conservation tillage also requires less machinery and less labor than conventional tillage. Reeves says, "A farmer may have to modify or purchase some new equipment with conservation tillage, but that will pay off with increased yields and less money spent on herbicides, fuel, and labor."

The plots in the experiment that use crop rotation have always raised the cotton yield some, but the rotations really improve yield when conservation tillage is used. Crop residues from the rotation crops and winter legume cover crops increase soil carbon or organic matter and improve water and nutrient use by the cotton and rotation crops.

The ARS and Auburn scientists have just started to add irrigation to half of the experiment. Reeves and Mitchell are curious to see how that will affect yields and soil quality when used with conservation farming. More information about the Old Rotation, including photos and charts, can be found at www.ag.auburn.edu/dept/ay/cotton.htm.—By **David Elstein,** ARS.

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