HIGHLIGHTS ONLINE

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Alabama's Old Rotation Experiment (circa 1896) and the Cullars Rotation Experiment (circa 1911) at Auburn University have set record or near record crop yields for these experiments over the last few years (see table).

The Old Rotation is primarily a cotton rotation study with corn, wheat, and soybean. It is the oldest, continuous cotton study in the world. The nearby Cullars Rotation is the oldest, continuous soil fertility study in the South and includes a three-year rotation of (1) cotton followed by winter legumes, (2) corn followed by wheat or rye, and (3) soybean double cropped with wheat or rye.

What has happened to account for such record productivity? Certainly, good weather has played a role, though there were some disastrous years (e.g., 2000) when no cotton or soybeans were harvested. Crops on these experiments are not irrigated and are therefore, totally dependent on rainfall, as are most Alabama farms. However, researchers contributing to the Old Rotation and Cullars Rotation experiments attribute high yields to a variety of issues including deep tillage, genetically modified crops, boll weevil eradication, conservation tillage, soil fertility, and cover crops.

Deep tillage increased yields because paratilling and/or subsoiling under the row resulted in deeper rooting of all crops and improved drainage for wheat. Soil at the Old Rotation is classified as a Pacolet fine sandy loam (Piedmont/Coastal Plain transition soil), and soil at the Cullars Rotation is a Marvyn loamy sand, a typically sandy Coastal Plain soil. Both tend to develop traffic pans (hard layers of soil that do not allow roots, nutrients, or water to move through the soil) when managed under conventional tillage. Both sites were conventionally tilled with moldboard plow and disked with no deep tillage until the early 1990s when occasional subsoiling was begun. Now deep tillage it is an annual operation because of the dramatic yield increases attributed to deeper rooting and drainage.

Genetically modified crops have had a remarkable impact on yield. Since 1996, Bollgard® cotton has been planted with higher yield potential and better worm control. Roundup Ready ® varieties of cotton and soybean and Liberty-Link® corn has improved weed control, which has eliminated the need for cultivation and reduced the need for most insecticides.

The boll weevil eradication program has eliminated the boll weevil as a major pest of cotton. As many as 15 applications of insecticides were needed each year in the late 1970s and 1980s just to keep the boll weevil and boll worm

complex in check. With almost no insecticide applications since 1996, beneficial insects have been able thrive, thus increasing yield and production efficiency.

Since 1997, all crops are planted in the experiments using minimum (strip tillage) or no tillage. In these conservation tillage regimes, crop residues are left as a surface mulch, increasing surface soil organic matter and improving soil quality. Less traffic from tillage equipment also means less soil compaction on the plots. Increased water infiltration, less runoff, and less soil erosion is a result of improved soil quality in some treatments.

Do these record yields require more fertilizer application? The answer is absolutely not! Record cotton yields in 2001 and 1994 (three or more bales per acre) were produced on treatments in the Old Rotation that has received ONLY legume nitrogen since 1896. No fertilizer nitrogen (N) has ever been applied to that plot; cotton is planted every year following crimson clover. Crimson clover should provide 75 to 150 pounds N per acre to the following crop of cotton or corn. In 2001, 2,570 pounds per acre of dry matter clover was produced from reseeding clover leaving 75 pounds N per acre in the residue. All plots received 60 pounds phosphorus (P_2O_5) and 60 pounds potassium (K_2O) per acre per year plus sulfate sulfur. The all-time record corn grain yield in 1999 was also produced on the Old Rotation using ONLY legume nitrogen. This yield was made on a three-year rotation plot where corn is planted every third year following crimson clover. No fertilizer nitrogen was added. Other crops in the rotation were cotton and double-cropped wheat and soybean. Soil organic matter is the highest as a result of this three-year rotation. Therefore, considerable organic N is already in the soil when weather conditions are suitable for outstanding corn yields, as they were in 1999. Many remember 1999 as a drought year, but the dry weather did not hit the Auburn area until after the corn crop was made in late June. Cotton and soybean yields in 1999 were disappointing.

A final factor in these increased yields relates to reseeding of clover as a cover crop on the plots. Reduced tillage on the Old Rotation has demonstrated that crimson clover can reseed itself in a continuous cotton system. The clover protects the soil in the winter and the residue on the surface improves soil quality and infiltration during the summer. Cotton is planted in early May into the mature 'AU Robin' crimson clover, which is killed with Roundup®. Row cleaners on the no-till planter are critical for removing clover residue in the strip where the cotton seed are planted. This prevents the decomposing clover residue from inhibiting cotton seed germination and emergence. Cotton stalks are cut as soon as harvest is completed in late September/early October. This allows germinating clover seed to become established before cold weather arrives. Using this technique, researchers have maintained a good clover stand for three years before having to replant again. This technique of reseeding clover has not worked as well for corn planted earlier in the growing season before the clover seeds mature.

Look for more innovative changes in these old experiments over the next few years. Half of the Old Rotation is to be irrigated in 2002. For the first time in 106 years, researchers will be able to actually measure the effect of periodic droughts on crop yields under the different rotation systems. While the Old Rotation and the Cullars Rotation Experiments on the Auburn University campus may be among the oldest, continuous field crop experiments in the world, they continue to demonstrate new and proven techniques and practices that can help modern farmers increase yields, increase profits, and protect the environment.

More photos from the Old Rotation can be viewed at:

Information and photos about the Cullars Rotation may be found at:

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Record Yields on the Old Rotation and Cullars Rotation Experiments at Auburn University

Crop	Rank	Year	Yield
Cotton	1	2001	1,600 lb. lint/acre
	2	1994	1,490 lb. lint/acre
	3	1993	1,270lb. lint/acre
Corn	1	1999	236 bu/acre
	2	2001	193 bu/acre
	3	1997	148 bu/acre
Wheat (1961-present)	1	2001	94 bu/acre
	2	2000	81 bu/acre
	3	1999	79 bu/acre
Oat (before 1960)	1	1958	109 bu/acre
	2	1937	97 bu/acre
	3	1956	87 bu/acre
Rye (1978-present)	1	1981	55 bu/acre
	2	1988	48 bu/acre
	3	1979	40 bu/acre
Soybean (1957-present)	1	1996	67 bu/acre
	2	1992	61 bu/acre
	3	1983	55 bu/acre