

Ultra-Narrow-Row Cotton

For more than a century, farmers planted cotton in wide rows about 30 to 40 inches apart. Their choices were limited, as was their equipment, which was usually just a mule-driven plow.

Today, farmers are experimenting with planting cotton much closer together, in rows ranging from about 7-1/2 to 10 inches wide. Research is under way at ARS locations to make production of this ultra-narrow-row (UNR) cotton more economical for farmers.

“With UNR cotton, a farmer can plant more rows and potentially harvest more cotton per acre,” says William T. Molin, a plant physiologist with ARS’ Southern Weed Science Research Unit in Stoneville, Mississippi. “Also, since rows are planted closer together, cotton crowds the weeds out, reducing the need for midseason herbicide applications.”

Molin and other ARS researchers are participating in a 10-year project looking at varying aspects of long-term UNR cotton production—from managing weeds to processing.

“There’s not enough solid information on UNR cotton available to farmers,” says Molin. “So they are either growing UNR cotton and seeing what works best, or they are avoiding it altogether because of lack of information.”

In 1998, Molin began field studies on 40 acres to compare UNR cotton with conventional cotton. “We grew 12 popular varieties, using both wide and ultra-narrow rows,” says Molin. “Our results showed the UNR crop was comparable in yield to conventional cotton.”

Molin also looked at key fiber characteristics of UNR and conventional cotton. Although the fiber characteristics are more favorable in conventional cotton—fibers are longer and less tangled—he says by improving crop management and harvesting techniques, UNR cotton quality should also improve.

“We’re working toward developing management systems that will establish

PEGGY GREB (K8706-7)



Samples of spindle-harvested, conventionally grown cotton (left) and stripper-harvested UNR cotton. Cotton harvested with a stripper harvester contains more stems and leaves.

criteria for growing UNR cotton in the Delta,” Molin says.

Conservation practices are important in growing cotton—a primary cash crop for early U.S. settlers. As they scurried to plant more acres in the 1700s, excessive planting allowed more soil erosion to occur. Now ARS scientists with the Soil Dynamics Research Laboratory in Auburn, Alabama, and the Coastal Plains Soil, Water, and Plant Research Center in Florence, South Carolina, are helping farmers put conservation practices that help prevent soil erosion to work.

For two growing seasons, ARS agronomists D. Wayne Reeves and Philip J. Bauer conducted a study to look at the effects of residue management and nitrogen fertilization on UNR cotton in Auburn and Florence.

“We used conservation tillage practices in ultra-narrow-row cotton,” says Reeves, with the Auburn unit. “The cotton was grown on Coastal Plains soils that are typically sandy, subject to soil compaction, and unproductive for row crops like cotton.”

Bauer adds, “We found the rate of

nitrogen fertilizer for UNR cotton should be between 60 and 80 pounds of nitrogen per acre—about the same as for conventional-row-width cotton on these soils.” He says that when cotton is planted after a legume cover crop, less nitrogen fertilizer is needed.

Another study using cover crops revealed a 60 percent higher lint yield when UNR cotton followed a cover crop of black oats or wheat, compared to conventionally planted cotton in 40-inch rows. Merging the UNR system with modern conservation technologies and using cover crops can reduce crop production inputs, conserve soil and moisture, and improve yields, says Reeves.

Examining Fiber Quality

Many farmers are concerned about the possible lower quality of UNR cotton. Researchers in the ARS Southern Regional Research Center’s Cotton Fiber Quality Research Unit, at New Orleans, Louisiana, are trying to ease their concerns.

Plant physiologist Judith M. Bradow’s specialty is scrutinizing the properties

that make cotton fiber the prized commodity it is today. Bradow and colleagues did side-by-side comparisons of UNR and conventional cotton fibers. Though their work is still preliminary, the scientists are finding few if any differences in lint fiber properties, unless it is harvested with a stripper harvester.

When a stripper is used, unwanted trash gets mixed into cotton. “Trash is primarily sticks—the stems that help support the bolls—and leaves that don’t fall off the plant,” explains Bradow. “Fiber properties start going downhill when you use the stripper harvester. Once trash gets stuck to the fiber, it doesn’t come off easily,” he says.

Farmers use stripper harvesters primarily for UNR cotton. Fingers or brushes strip plant parts and cotton bolls from the plant, thus picking up excess trash. “This is a negative aspect of harvesting UNR cotton, particularly for ginners,” says W. Stanley Anthony, an agricultural engineer with ARS’ Cotton Ginning Research Laboratory in Stoneville, Mississippi.

Most conventionally grown cotton uses a spindle harvester that has many rotating barbed spindles. The spindles grasp the fiber and selectively pull it out of the boll, leaving unwanted plant parts or trash behind. Spindle harvesting yields about 100 pounds of trash per bale compared with 400 pounds of trash per bale from stripper harvesting. A bale is 500 pounds of fiber.

In a 1998 gin study, Anthony found that UNR cotton quality measured up to that of conventionally grown cotton based on traditional grading. He evaluated cotton grown at 10 locations in the South and Southeast.

Anthony says that when additional cleaning machinery was used for the UNR cotton at the gin, the grades of UNR cotton were equivalent to those of conventional cotton. But since more gin machines are used and more material must be processed, it costs more to gin UNR cotton, and the fiber suffers more

damage—mainly in the form of increased neps and shorter fibers.

Cleaning Is the Key

Once the UNR cotton was ginned at Stoneville, Anthony sent it to ARS’ Cotton Quality Research Unit at Clemson, South Carolina, where it was processed at the pilot spinning plant. Initial evaluation by textile researcher David McAlister showed minimal disadvantages during textile operations.

“Our 1998 study showed only minor differences in fiber properties between UNR and conventionally grown cotton,” says McAlister. “However, the differences in fiber properties did not affect the quality of the yarn.” He’s hoping their research will help cotton mills understand how to process and handle UNR cotton.

Supporting this evidence, a previous study conducted at Clemson gave now-retired ARS scientist Charles K. Bragg a clue as to how UNR cotton might act in textile processing. He says that limited preliminary experiments suggest UNR cotton does not act differently than standard conventional cotton.

UNR in Other Regions

V.T. Walhood, in Shafter, California, who has since retired, conducted pioneering experiments in the 1960s through 1980s on the growth and yield of ultra-narrow-row cotton. His experiments showed that planting three rows of early-maturing cotton in the space normally allocated for one row of a mid- to late-season cotton produced the same yield and gave a bonus: They harvested the early cottons before populations of pink bollworms had a chance to build up to troublesome levels.

Another Shafter scientist, Angus Hyer, included narrow-row cottons in his research nursery of more than 150 experimental lines. When he offered his experimental cottons, with features such as improved resistance to insects or diseases, to commercial breeders in the

DAVID WRIGHT (K8719-1)



Cotton stripper harvesting UNR cotton near Altha, Florida.

D. WAYNE REEVES (K8719-2)



UNR cotton planted into a cover crop of black oats. Narrower rows promote canopy closure in just 33 days, helping to reduce erosion and control weeds.

late 1980s, most U.S. cotton seed companies tried some.

Several years after Hyer’s death, F. Douglas Wilson, a collaborator at ARS’ Western Cotton Research Laboratory, Phoenix, Arizona, scrutinized Hyer’s collection to make sure the best-performing lines made their way safely into ARS genebanks as permanent resources for breeders worldwide.

At Lubbock, Texas, ARS scientists in the Cotton Production and Processing Research Unit are also conducting experiments comparing yield and fiber quality of UNR versus conventional cotton using two varieties. ARS agricultural engineer Alan D. Brashears harvested 40-inch-row cotton and narrow-row cotton. “Our preliminary results showed there wasn’t much difference in quality or yield between UNR and conventional cotton,” he says.

Soil scientist R. Louis Baumhardt, at ARS’ Conservation and Production

Research Laboratory in Bushland, Texas, is testing whether UNR cotton can be grown in the northern Texas Panhandle. Farmers in this area usually don't grow cotton because yields are low from cooler temperatures and a shorter growing season. Instead, they grow grain sorghum and wheat with rest periods in between. However, by using new early-season cotton varieties and by growing more plants per acre, farmers could boost cotton yields enough to make the crop more profitable than wheat.

The Bottom Line Is Profits

With low commodity prices and tough international competition, farmers are

looking hard at the economics of growing cotton. Current information about the economics of UNR cotton production is lacking. Martin Locke, head of the Southern Weed Science Research Unit, and Ray Williford, head of ARS' Application and Production Technology Research Unit in Stoneville, began cooperative studies this year to evaluate UNR cotton in various tillage and irrigation systems.

Results from these and other studies could mean a promising future for UNR cotton.—By **Tara Weaver-Missick, Hank Becker, Don Comis, Jan Suszkiw, and Marcia Wood, ARS.**

This research is part of Soil Resource Management (#202), Integrated Farming Systems (#207), Crop Protection and Quarantine (#304), Crop Production (#305), and New Uses, Quality, and Marketability of Plant and Animal Products (#306), ARS National Programs described on the World Wide Web at <http://www.nps.ars.usda.gov>.

Scientists mentioned in this story can be contacted through Tara Weaver-Missick, USDA-ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD 20705-5129; phone (301) 504-1619, fax (301) 504-1641, e-mail tweaver@asrr.arsusda.gov. ♦

WILLIAM MOLIN (K8720-1)



Standard wide-row cotton (40-inch rows) growing among UNR cotton.