UNR Cotton Production System Trial in the Mid-South

Dr. Tom Kerby
Vice President, Technical Services
Delta and Pine Land Company
Scott, MS

When something works for us, we tend to stay with it. However, in this day of innovation and change it is important to take advantage of new opportunities for cost reduction if they become available. Ultra Narrow Row (UNR) has been tried on some farms and has been shown to work. Others have tried it and not been successful. There are needs to evaluate the system for potential to increase farm profitability. There are several reasons most US cotton farmers currently use conventional row spacing (30-inches or more):

- Tradition - wide row spacing evolved to facilitate draft animals.
- Skip row patterns to optimize government payments.
- Lack of suitable harvest equipment to replace spindle picked cotton.
- Wide row spacing may reduce boll rots when accompanied by strong growth and high humidity.

Physiological Aspects of Row Spacing

From a physiological and production point of view, cotton needs to develop leaf area to harvest sunlight and make carbohydrates available for developing bolls. There is a complex relationship between producing carbohydrates (source) and utilizing them by developing bolls (sink). Planting configurations can have an influence on these source to sink relationships.

If rows are wide, plants must grow big to "fill the space". Big plants generally have a lower harvest index (boll weight divided by total plant weight) because of the dry weight allocated to stems and leaves. Plants with high harvest index usually begin fruiting at a low node, have high boll retention, and the boll load limits vegetative growth (plants are small). While this may be an efficient plant as far as harvest index is concerned, yield would be disappointing because plants would not be large enough to cover between rows (total dry weight of the field would be small).

The ideal size plant for a field will depend on the length of the growing season, the capacity for the soil to produce a large plant, and the row spacing. For maximum photosynthesis, enough leaves must be present to harvest the sunlight. Rows typically close in 40-inch row spacing when plants are 30 inches tall.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:87-88 (1998)
National Cotton Council, Memphis TN

If rows are very close together, such as 7.5-inch rows with 7.5 inches between plants in a row, there would be approximately 110,000 plants per acre. These plants do not excessively compete early because they are equally spaced. However, this configuration harvests all the sunlight well before the 16 to 17 node stage with a plant that averages only 24 inches. UNR closes the canopy early providing increased competition with weeds.

In a UNR system the emphasis is on early fruiting and growth control. The leaf area of each plant is limited. A few bolls per plant has the capability of "using" all the carbohydrates produced by leaves. Three bolls per plant at this plant density can produce yields in excess of two bales per acre. Because it can set three to four bolls in a short period of time, the length of the growing season can be reduced. The system has the potential to be ultra early with water, pest control, and harvest cost savings.

Ultra narrow row has received most successful on soils where plant growth is severely limited. Under these conditions UNR may increase yields. It may also fit very well into reduced tillage systems. The availability of new over-the-top herbicides and transgenic herbicide tolerant varieties make the system more attractive.

UNR System Trial at Scott, MS in 1997

Tests were designed to determine how much yield could be set in a short period of time in UNR compared to conventional row spacing. DP 5415 RR was planted in 7.5-inch rows with an average of 6.0 inches between seed in the row. A tandem planter (two sets of tool bars - each with an offset planter) was used to plant the 7.5-inch row spacing. DP 5415 RR was planted in 40-inch rows in a field approximately ¼ mile away. Both fields are Deer Creek soils with high growth potential.

Table 1 provides yield, management practices, and summary final plant map data for the two different systems. Yield of the two fields were similar. UNR cotton can show significant yield increase when plants do not obtain adequate size to canopy over. For good soils, the yield increase potential from UNR may be modest. Because of the potential for late season rain, UNR was limited to only 1 irrigation and 50 pounds per acre nitrogen. The field probably could have been managed to be slightly higher yielding, but it would have increased the risk of unwanted late season growth if late rains would have occurred. The last Pix application of 16 oz./A (to both fields) were not necessary because of late season weather. They were an insurance policy against a wet fall.

The UNR field had only 70 percent of the height and 75 percent as many nodes as conventional cotton. This was consistent for management to avoid vegetative growth on these strong soils. Node of the first boll was similar for both fields. Normally under high plant population, the node of the first boll can increase. With UNR cotton, plants are nearly equally spaced, and interplant competition is not

severe early when the node of the first fruiting branch is being determined.

Ninety five percent of the yield was produced on 1st and 2nd positions in UNR compared to only 73 percent for conventional spaced cotton. High density in UNR caused DP 5415 RR to express a "columnar" plant type. Vegetative branches were nearly eliminated and branch length was shortened. These plants presented themselves well to the broadcast stripper.

A major difference between the two fields was the node with the last harvestable boll (the 95 % zone). The last effective flower was produced at the 1st position on node 13.7 compared to node 19.2 for the conventional row spacing. UNR yield was produced on only 6.4 nodes compared to 12.0 for normal row spacing. This difference of 5.6 nodes represents at least 17 days of earliness (5.6 nodes * 3 days per node). Late in the season there is probably a difference of more than 3 days per node in the rate at which bolls open. The boll load accumulation of both fields is graphically demonstrated in figure 1.

UNR Management is Critical

While UNR cotton offers many benefits, management is critical. With herbicide tolerant cottons, weed control has become much easier, and it facilitates reduced tillage. Both of these represented significant challenges in UNR in the past, but herbicide tolerant varieties have provided a good solution. Many other elements in management remain critical for successful UNR cotton production:

- A uniform plant density is important to avoid skips. Any skips will produce large plants with vegetative limbs. These plants will be pulled up by broadcast strippers if the soil is moist. Additionally, they provide a good source of bark as the fingers run through them if harvest conditions are anything but ideal.

- Excess plant growth must be controlled. Tall plants will create a heavy canopy resulting in high levels of boll rots. Fingers on broadcast strippers will remove more bark and trash with tall plants. Tall plants also create an environment that makes good defoliation and drying more difficult.
- Early boll set is important to get earliness. This saves water and pesticides, but also facilitates harvest during more favorable weather.
- Growth stimulating inputs such as high N and excess water must be avoided. They promote excess growth with the ill effects already discussed. Use of Pix is more likely in UNR, especially on good soils. Early application is more important than high application rates.
- Good defoliation is critical. Any green leaf tissue will keep moisture higher.
- Cotton must be harvested dry. Harvest can begin at an earlier date, but the number of hours per day for stripping are less than for picking.

UNR Limitations and Research Questions.

- How narrow should rows be? While 7.5-inch rows may be desirable for equal distance plant spacing, this row spacing limits harvest possibilities, and decreases planting options. Can the same results be achieved with 15-inch rows? Wider rows would create more planter and harvest options.
- Do seed companies need to develop columnar plant types for UNR cotton?
- Can improvements be made in planting equipment to provide precision planting?
- Is a broadcast stripper our only option for harvest?
- Gins have had a reluctance to handle UNR cotton. They have less resistance than they once did. Sound crop management is a key to acceptable ginning. Is there new gin technology that will facilitate UNR?
- The mill is our ultimate customer. Can we demonstrate that quality cotton can be consistently delivered?

UNR appears to be more than a fad at this time. Herbicide tolerant cottons, improved growth control methods, and a need to reduce costs have made the system more attractive. Growers are great innovators and many are making it work. Research is needed to help those who are adopting the system use it to their optimum benefit.

Table 1. Comparative data for a UNR and conventional row spacing field grown at Scott, MS in 1997.

Factor	UNR (7.5-inch)	40-Inch
Lint Yield (lbs/A)	1394	1340
Bolls per Plant	3.4	8.0
Date of Planting	May 8	May 6
Plants per Acre	115,000	45,000
Nitrogen Fertilizer (lbs/A N)	50	90
Herbicides	Tref., Staple, Roundup	Tref., Pre (2), Post (3), and a Layby
Number of Irrigations	1	2
Total Pix Use (oz./A)	36	54
Defoliants	Starfire-Chlorate	Starfire-Chlorate
Final Plant Height (inches)	23.7	33.6
Total No. Nodes	16.8	22.3
Node of 1st Boll	7.4	7.2
% Bolls on 1st Position	75.7	48.1
% Bolls on 2nd Position	19.0	24.4
% Bolls on > 2nd Position	0.4	13.8
% Bolls of Vegetative Branches	4.9	13.7
No. Nodes for 95 % Zone	13.7	19.2
No. Nodes to Set 95 % of Crop	6.4	12.0

Figure 1. Percent of Bolls by node equivalent age (node 12 1st position = node 10 2nd position = node 8 3rd position) for UNR and conventional row spacings at Scott, MS in 1997.