

## Production of Ultra Narrow Row Cotton<sup>1</sup>

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Some growers in Florida are switching to narrow row production and stripper harvesting of cotton in an effort to reduce the amount of cotton that is left in the field during harvest with conventional spindle cotton pickers. Even though seed costs will be higher for narrow row cotton, harvest costs and higher yields may make it more profitable. However, only a small part of the crop is currently grown in this manner since planting and harvest operations are quite different from conventional row width cotton. Farmers who grow row crops generally have their equipment set up to plant several crops with the same equipment with only minor adjustments made when changing crops. Most of the Florida cotton is grown in 36-inch rows for weed and insect control purposes as well as for harvesting with conventional pickers. However, incorporation of genetic technology into cotton varieties (*Bacillus thuringiensis* or Bt for insect resistance, and for herbicide resistance Roundup Ready, BXN, Liberty Link, and others) has resulted in the ability to produce cotton in 7- to 10-inch rows and as wide as 15 inches for harvest with a cotton stripper. This production system is called **ultra narrow row** (UNR) production, which started in Florida due to the amount of hardlock or

cotton that could not be harvested with a conventional spindle picker. Stripper harvesters will harvest all bolls including the hardlocked bolls and those that are poorly opened. A great deal of excitement is present in some areas of the state where yield increases and lower harvest and labor costs have been observed.

There are still many issues to be resolved before UNR cotton production is widely adopted across the cotton belt. There are concerns about uniformity of stands (since cotton is often planted with a grain drill or no-till drill), seed costs, plant populations, fertilizer rates and timing, ginning costs, marketability, bark or trash content in the lint, spinning problems, and availability of planting and harvesting equipment. These issues are being addressed by researchers and growers across the cotton belt. This article presents the most up-to-date findings of research that has been or is currently being conducted in Florida and other universities in the southeast on UNR cotton. It is not intended to be a definite recommendation list for everyone in all situations but may help those who are interested in this type of production system.

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## VARIETY SELECTION FOR UNR COTTON

Little is known about varieties best suited for UNR production. Research data from the southeast shows that many of the early- to mid-season varieties that are used in wide row production will also work in a UNR system. Stripper-type or "stormproof" varieties are often used for stripper harvest in Texas, but generally have not performed well in the humid southeast and may contribute to excess trash due to tight burs. Our data shows that conventional variety trial information may be used for choosing best varieties for UNR. Therefore, the top yielding varieties in wide row production should be best for UNR production.

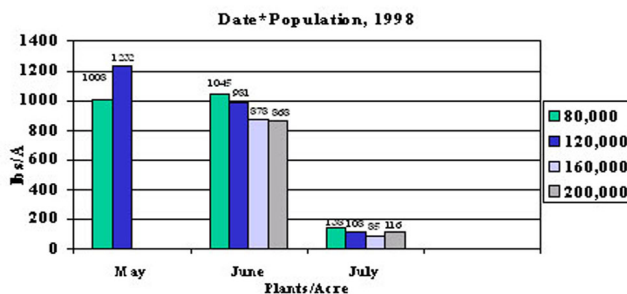
Observations indicate that most common varieties, when planted at high densities and managed properly, will not branch excessively and make stripper harvest more efficient. When planting late, an early variety will probably be best, although extremely early varieties have not performed well in limited testing.

### Plant Population

Thick, uniform stands are critical to force cotton into a compact plants with few side branches for efficient and clean harvesting with a stripper. Cotton planted in 10-inch rows with 2-3 plants per row foot has resulted in plant types that harvest well with a stripper harvester. Dense canopies early in the season will also reduce weed competition. Recommendations vary widely, but most researchers recommend from 80,000 to 150,000 plants per acre. Some of our best yields in Florida have come from final stands of 100,000 to 110,000 plants per acre.

Investigations at Auburn University evaluated time of planting and plant density in UNR cotton. At 150,000 plants per acre, 3-4 bolls per plant set at the first or second fruiting position can yield 2-2.5 bales per acre. On sandy soils, or when moisture stress occurs in late in the season, high plant densities may result in competition for moisture and this could cause yield reductions (see Figure 1 below).

## Lint Yield at E.V. Smith (AL)



**Figure 1.** Effect of planting date and plant population on yield.

### Fertilization of UNR Cotton

In the last few years many questions about fertilization of UNR cotton have been asked. The questions most often asked are:

1. Will demand for nutrients be greater since plant populations are so high?
2. Should one cut back on nitrogen fertilizer so that cotton will not grow too tall?
3. What effect will a shorter fruiting period have on cotton fertilizer needs?

Most fertility questions on UNR cotton have not been fully studied for the southeast. The following are suggestions based on current and limited research findings and observations.

### Nitrogen Fertilization

In Florida, nitrogen (N) fertilizer recommendations for cotton vary from 60 pounds per acre on the heavier textured soils to 90 pounds per acre on the sandy soils. Nitrogen fertilizer recommendations are reduced by 30 pounds of N when following a legume crop such as soybeans or peanuts or when soils have a history of producing rank growth. In conservation tillage, when strip till planting cotton into small grain cover crop residues, add an additional 30 pounds of N to help decompose the straw residue so that needed N for plant growth is not limited. However, if small grain were grown for grain, a total of 120 pounds of N is often used during the at-plant and sidedress operations, leaving as much as 60 pounds of residual N in the soil that can result in too much N for cotton crop if normal rates are applied, resulting in hardlock and boll rot problems.

Current research and farmer experience has shown that these N fertilizer recommendations provide the basis for N fertilizer rates needed for UNR cotton. Huge reductions in N rates will reduce stalk growth and can limit yield potential, especially during dry growing seasons. The nitrogen provided by a previous crop or additional N needed to decompose a small grain cover crop will be important considerations on total N needs.

### Potassium Fertilizer

Research with potassium (K) fertilizer rates on UNR cotton is limited. However, unpublished research by Mullins in central Alabama has indicated UNR cotton may require a greater amount of potassium fertilizer compared to cotton grown in a standard row spacing (Table 1). This study also showed lower micronaire with UNR cotton as compared to cotton in standard rows. Potassium plays an important part in increasing cotton micronaire. Some of these differences observed in the study may have been due to the late planting date (June 4th). However, with the high plant population of UNR cotton and heavy potassium demand during boll fill, there may be a need to increase K fertilization for UNR cotton.

### Other Nutrients

Other nutrients needed in UNR cotton production, such as phosphorus (P), sulfur (S), magnesium (Mg) and boron (B) should follow standard soil test recommendations for conventional cotton production until additional information is available.

### Plant Growth Regulators

Current harvesters for UNR cotton require that cotton be kept fairly short for efficient and clean harvesting. Many adapted varieties will grow very tall with good growing conditions; therefore, growth regulators will continue to be needed until short adapted varieties are available.

Mepiquat chloride (Pix and other formulations) should be applied beginning at pinhead to matchhead square, which is earlier than normal for wide row cotton. Because it is important to control cotton

growth as it occurs, one or two early applications will likely be more effective than trying to apply larger amounts later. Since UNR cotton has a short window of fruiting, growers will need to be attentive and timely in monitoring and applying treatments.

Depending on rainfall, fruit load, fertility and other factors, UNR cotton may require anywhere from 8 to 24 oz/A of mepiquat chloride to control growth. Some varieties may require higher rates of growth regulators to reduce excessive growth. Research is underway to find improved ways to decide how much and when to apply growth regulators. Current approaches are shown below:

The standard program should begin by applying 8 oz/A between pinhead and matchhead square stages, then applying another 8-16 oz within 10-14 days depending upon crop growth, using low rates to maintain desired growth and the higher rates as cotton becomes very large or vigorous. In studies, a total of 16-24 oz/A have been used in Florida. If cotton holds fruit early and the weather is dry, less mepiquat chloride may be needed.

Monitoring of the top 5 nodes can also be used as a guide to the use of mepiquat chloride, with maximum internode distance kept to 2 inches or less. Growers need to be careful monitoring at least once a week, especially during periods of high rainfall or good soil moisture.

## WEED MANAGEMENT IN ULTRA NARROW ROW COTTON

Optimum cotton yield and quality for UNR cotton requires good weed control throughout the growing season. Standard cotton varieties will require the use of residual herbicides such as trifluralin (Treflan, etc.), Prowl, Cotoran, Zorial, Command, and Staple. Transgenic varieties, such as those with butrill or glyphosate tolerance genes, allow over-the-top use of Buctril, and until a certain growth stage with Roundup and other glyphosate products, respectively. Conventional row cotton allows mechanical cultivation and post-directed spraying between rows to manage weeds after the crop emerges, but UNR cotton will not currently allow the use of cultivators or post-directed sprayers. **All herbicide treatments in UNR cotton must be**

**applied on a broadcast basis.** Most studies show that narrow row cotton will provide a soil canopy in about 30 days as compared to 60-75 days for conventional row widths which will shade out weeds and reduce their competitiveness.

UNR cotton should receive trifluralin or Prowl incorporated or preemergent to the crop at 0.5 to 1.0 lbs active ingredient per acre. Fields infested with sicklepod, morningglory, cocklebur, or prickly sida, should also receive a preemergence treatment of Cotoran alone or mixed with Zorial or Command at the standard rate for each soil type. Postemergence treatments of Staple alone or with MSMA/DSMA can be applied over-the-top to all varieties for control of several broadleaf weeds until cotton starts to bloom. If BXN cotton is used, Buctril alone or with MSMA/DSMA can be applied over-the-top for control of broadleaf weeds until cotton starts to bloom. Roundup Ready varieties should not be sprayed over-the-top with Roundup or other glyphosate products after the crop has passed the 4-node stage. Staple herbicide alone can be sprayed on Roundup Ready, BXN, and standard cotton varieties until 60 days prior to harvest. Staple does not control weeds over 4 inches in height and only suppresses other weeds such as sicklepod. Dual may be applied at the 4-leaf stage with Roundup or similar materials in fields known to have heavy infestations of tropical spiderwort (also known as dayflower). However, Dual should not be used preemergence due to damage to cotton. Once UNR cotton, regardless of variety, has 60% of the bolls open, Roundup or other glyphosate materials may be applied for preharvest weed control.

Conventional varieties of UNR cotton grown using conservation tillage (no-till, strip till, minimum till, etc.) should receive a preemergence broadcast application of Prowl + Cotoran at 1.0 + 1.5 lbs active ingredient per acre. Complete burn-down of emerged winter vegetation is extremely important before planting UNR cotton. The same herbicide treatments used in conventional tillage UNR cotton can be used in conservation tillage UNR cotton. Some studies using Roundup Ready varieties have shown excellent weed control with no preemergent herbicides, but when followed by Roundup and MSMA/DSMA and postemergent grass materials, best results have been

obtained. However, with Florida's weed spectrum, using a postemergent-only weed program may not give satisfactory results if rotations with other crops and herbicides do not control those weeds that glyphosate has failed to control.

Considering the current state of weed management tools available for weed control in cotton, we strongly suggest that transgenic varieties be used in UNR cotton. If sicklepod is present in the field, we suggest that a Roundup Ready variety be used; if morningglory is the main problem, use BXN varieties or use herbicides that reduce morningglory populations before morningglory become too large to control. If tropical spiderwort has become a problem, apply Dual over the top of cotton at the 4th node stage. On glyphosate resistant cotton, this can be tank mixed with the glyphosate materials.

## INSECT CONTROL IN ULTRA NARROW ROW COTTON PRODUCTION

Ultra narrow row (UNR) cotton production can have a significant impact on insect management, but little concrete information is available for making appropriate adaptations to insect control strategies. Nevertheless, some of the potential differences between UNR and conventional row cotton production will be discussed below.

The most obvious difference between conventional and UNR cotton is the plant population and the row feet per acre. Increasing the plant population from 50,000 to 125,000 plants per acre and switching from 36-inch to 7-15-inch rows means changing from 14,520 to 3 to 5 times more linear feet of row per acre. Any control method or economic threshold based on a per plant or per row foot basis will need adjusting.

Thrips control in UNR production is one area of insect management that most farmers have felt compelled to alter. Good thrips control is essential to a good stand and without an adequate stand, management of UNR cotton is difficult. Thrips control based on a row foot or per seed basis becomes quite expensive. If in-furrow and seed treatment applications are eliminated as control options, the

choices become very limited. However, some growers have adapted Temik boxes to drills and used rates of 6 to 9 lbs./A with satisfactory results. Yet another option tried by some producers is to use Orthene as a hopper box treatment or make an automatic foliar application at the first true leaf stage and then treat as needed. Another option is to use only foliar applications. In this case, the first application should be applied just after plant emergence, followed by a second application in 7-10 days. Subsequent applications can be applied as necessary. The biggest problem associated with foliar applications for thrips are poor control due to poor timing and the possibility of rapid build up of aphids and possibly even spider mites due to the disruption of naturally occurring predators.

Most farmers who have eliminated in-furrow controls as an option have done so by comparing UNR and conventional cotton rate-for-rate. In other words, if row feet per acre increases by 5X, then the conventional thrips control cost of \$12.00 per acre is calculated as \$60.00 per acre for UNR production. This rate-for-rate transfer may not be necessary. Preliminary data are available to show that a 2X rate of an in-furrow insecticide may be enough to provide adequate control. More studies need to be made in this area.

Insect pests such as plant bugs, stink bugs, and the many caterpillar species are a potential problem for UNR cotton just as they are for conventional row cotton. They may even be more important due to the compacted fruiting period involved with UNR cotton. Most of the thresholds for these insects are based on damage or a number of insects per so many plants or so many row feet. Thresholds based on insects per 100 plants do not need to be changed regardless of row spacing. These thresholds are based on the fact that an individual worm will damage a certain number of squares and /or bolls during its feeding period. It doesn't matter whether these fruit are on one or 4-5 plants. Where percentage of damaged fruit is used as a threshold, little adjustment should be necessary. Individual plant samples would not require much modification between UNR and conventional row widths. However, a sweep net and shake cloth sampling procedure would need to be modified, and a shake cloth method may not be even feasible.

Pests such as aphids, whiteflies, and two-spotted spider mites should not present any additional difficulty due to reduced row widths. All pests can be indirectly impacted by UNR production if the crop is very late or if it differs dramatically in any other way.

Insects usually come in generations; they are either very abundant or virtually absent. Except for the occasional "close call," insect control decisions in UNR cotton production have not presented any insurmountable problem. As we make further discoveries and refinements, insect problems should not limit UNR cotton production.

## **IMPACT OF ULTRA NARROW ROWS ON DISEASES AND NEMATODES**

The ultimate effect of UNR on diseases and nematodes of cotton is unknown at this time. However, limited experience with UNR plantings and extensive experience with conventional plantings indicate that several aspects of pathogen control may be affected. Seedling diseases on cotton are caused by a wide range of organisms, mostly plant pathogenic fungi. They can be extremely devastating when poor seed is used, or planted too deep or in soil that is too cold and wet. The best way to avoid seedling disease problems is to plant good seed when the soil is warm. One method is to plant when the soil at 4 inches deep has reached at least 65° F by 8:00 AM. This cultural practice, combined with appropriate fungicides, if warranted, should be practiced for UNR and conventional cotton plantings. Since UNR cotton requires greater seed costs (more seed used per acre), it is extremely important to establish a good stand initially. Seedling spacing should not increase the chance of seedling diseases spreading, because the seedling rapidly "hardens off" to infection if soil is warm enough.

Boll rots may increase due to rank growth if UNR cotton is over-fertilized and/or growth regulators are not used correctly. However, higher density plantings often naturally reduce foliar growth of the plant due to the high level of competition. Studies in Florida are underway to quantify the microclimate within the canopies of conventional and UNR cotton to obtain better information on the actual changes taking place.

UNR cotton has an advantage at harvest. Cotton grown in Florida often has some degree of hard-locked bolls. Plants as well as root systems are smaller when grown in narrow rows with bolls near the top of the canopy. Bolls that are hardlocked can be harvested with a UNR finger stripper header while spindle pickers often knock the locks off the plant. Over a four year period, tests in Florida have shown an increase in lint yields of 200 to 600 lbs/A. Much of this increase is due to increased efficiency of harvesting the hardlocked bolls instead of knocking them to the ground.

The incidence of nematode disease problems in cotton has grown in Florida due to increased acreage and little or no rotation in some fields. The major nematodes causing disease include southern root-knot, reniform, and sting. Studies have not found major differences in nematode population densities between UNR and conventionally planted cotton. Studies to date indicate a similar percentage loss from threshold nematode population levels in both UNR and conventional cotton when planted at recommended seeding rates. Increasing seeding rates in UNR cotton may be useful to reduce overall nematode damage. One study indicated that raising plant population from 120,000 to 180,000/A increased cotton yield by 43% in a reniform nematode-infested field. It is suspected that plants less severely affected by nematodes compensated for those more severely infected. The use of nematicides in UNR cotton requires higher rates and different application methods than conventional cotton, and nematicide units have been adapted to narrow row planters. Principles similar to those already discussed in the thrips management section of this fact sheet may be used. The two nematicides most commonly used in cotton are Telone II and Temik 15G. Telone II is typically applied in-row with a single chisel in conventional cotton, but this chemical must be applied as a broadcast treatment in UNR cotton. Chisel spacing should be no further apart than 18 inches. Research has shown that the rate of Telone II should be doubled in UNR as compared to conventional cotton. It is suspected that a similar doubling of Temik 15G rates will be required (10-14 lbs./A). Thus in the absence of good rotation systems, nematode management of UNR cotton will likely cost more than that of conventional planted cotton. For

more information on nematicide application on UNR cotton go to: <http://edis.ifas.ufl.edu/IN466> .

### Harvest Preparation

Harvest aides registered for standard row cotton are also used in UNR cotton. The primary difference is that some researchers have suggested that UNR cotton must also be desiccated after defoliant and boll opening chemicals are used. All green material must be dried down before harvest to avoid staining the lint. The timing of applications is important. Defoliant and/or boll openers should be applied when the topmost boll to be harvested is mature. Since UNR cotton bolls are set in a short period of time, the "0% open" rule of thumb may not apply. The timing on when to apply defoliant can be determined by slicing a few bolls and assessing the maturity of the lint and seed coat. If the boll is hard to slice with a sharp knife and the seed coat is dark brown, then a defoliant or defoliant/boll opener combination can be applied. This application should be followed within 8 to 11 days with a desiccant such as paraquat, sodium chlorate, Quickpick, or combinations thereof. Harvest should be scheduled 3 to 5 days after the desiccant application. Delaying harvest several days after desiccation will increase the likelihood for bark and trash contamination.

### Key Production Factors

1. Choose best varieties for the location.
2. Apply proper rates and kinds of fertilizer and lime (soil test).
3. Plant on a timely basis (April- mid May).
4. Use conservation tillage planting methods where possible.
5. Ensure a proper seedbed to establish uniform stands.
6. Sidedress with N at early squaring and no later than second week of bloom for additional applications.
7. Apply growth regulators to keep plants compact.

8. Use IPM procedures for pests.
9. Defoliate on a timely basis (60% open bolls) and then desiccate 8-10 days later.
10. Harvest 3-5 days later.

**Table 1.** Effect of potassium fertilizer rates on cotton lint yield and micronaire at the Prattville Experiment Station.<sup>1</sup>

K Rates lbs K <sub>2</sub> O/acre	Ultra Narrow Row Cotton		40-Inch Cotton	
	Lint lbs/acre	Micronaire	Lint lbs/acre	Micronaire
0	554	2.83	386	3.42
30	784	3.20	435	3.63
50	862	3.20	482	3.84

<sup>1</sup>Unpublished data by Mullins, Auburn University. Cotton planted on June 4, 1997.