A THREE-YEAR STUDY OF UNR COTTON

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Abstract

A three-year study of ultra-narrow row (UNR) cotton production was conducted at the University of Arkansas Northeast Research and Extension Center at Keiser during the 1995 through 1997 growing seasons. The study compared UNR cotton with cotton produced in 38-inch rows. As expected, the plants in the UNR system were shorter with fewer nodes and fewer bolls per plant than in the conventional system. Higher seedcotton yields were observed for UNR two of the three years, but lower gin turnout offset part of the increase. Of the HVI fiber properties, only micronaire was significantly affected, consistently lower for the UNR cotton. However, Advanced Fiber Information System (AFIS) analyses indicated more visible foreign matter, higher short fiber content and more neps associated with the UNR system. Production costs were higher for UNR cotton in this study, but omitting the seed treatment would have had a large effect on the UNR system's cost. Breakeven prices for both systems were below the season average price two of the three years, even allowing for a crop rent, suggesting a potential for profit.

Introduction

Cotton (*Gossypium hirsutum* L.) is usually grown with row spacings of 30 inches or more. Researchers have studied row spacing effects for many years, with Vories et al. (1992) reporting on some of the work conducted in Arkansas. While some of that work dealt with row spacings less than 30 inches, lack of effective over-the-top weed control for cotton limited interest in those systems. Recently, however, new herbicides and the introduction of transgenic cultivars with resistance to certain herbicides have greatly increased interest in production systems commonly referred to as ultra-narrow row (UNR). The objective of this study was to compare UNR cotton production to conventional 38-inch-row production.

Methods and Materials

A three-year study of ultra-narrow row (UNR) cotton production was conducted at the University of Arkansas Northeast Research and Extension Center at Keiser during the 1995 through 1997 growing seasons. The study compared UNR with cotton produced in 38-inch rows (conventional). The soil in the study area is classified as a Sharkey silty clay (Vertic Haplaquepts) and the previous crop (1994) was fallow. UNR plots were seeded with a no-till grain drill with a 7.5-inch drill spacing at a rate of approximately 3 seeds/ft (209,000 seeds/acre). Conventional plots were seeded with a planter at approximately 5 seeds/ft (69,000 seeds/acre). Triple-treated seed was used and no in-furrow fungicide. The cotton was not irrigated.

A total of 125 lb N/acre was applied, split between early season (75 lb N/acre) and first flower (50 lb N/acre) aerial applications of ammonium nitrate. Other fertilizers were not required. U of A CES recommendations for 38-inch row spacings were followed for weed and insect control. Because there were no recommendations for UNR cotton, the conventional recommendations were adapted where appropriate. In most cases, the whole field (i.e., both row spacings) was treated together with herbicide or insecticide. However, the conventional plots were cultivated and post-directed herbicides applied as needed. Costs for the inputs and operations were estimated with the Mississippi State Budget Generator (Spurlock and Laughlin, 1992). For the comparison, the stripper and picker were assumed to have the same performance rate.

The field was treated with defoliant (0.75 lb tribufos (Folex)/acre) and boll opener (2.0 lb ethephon (Prep)/acre), followed by desiccant (0.375 lb paraquat (Starfire)/acre) each year to prepare for harvest. Because aerial application was used for the harvest aids, it was necessary to treat the entire field. However, because desiccant was not required for the conventional cotton, the treatment was not included in the cost calculations for the conventional treatment. In addition, a higher desiccant rate (0.625 lb paraquat/acre) was mistakenly applied in 1996. The additional material was not believed to affect the crop and the costs were calculated based upon the intended rate (0.375 lb paraquat/acre).

The conventional cotton was harvested with a two-row cotton picker. The UNR cotton was harvested with an Allis Chalmers 880 stripper with a platform header and on-board cleaning. The seedcotton from each plot was kept separate for ginning. Seedcotton weights were determined for each plot with wheel scales in 1995 and with an instrumented boll buggy in subsequent years. Seedcotton was held until the end of the ginning season and then ginned at the Wilson Gin. Trailers were weighed before and after each bale of cotton to allow calculation of a separate gin turnout (percentage of lint produced from seedcotton) for each bale. All gin settings (temperature, degree of cleaning, etc.) were the same for the conventional and UNR cotton. Information on grade, discounts and HVI analysis was obtained from the gin for each bale based on samples sent to the Memphis, TN Cotton Classing Office.

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At the time of harvest, whole plant samples were collected for COTMAP analysis (Bourland and Watson, 1990). Ten plants were collected from two sites per plot (one site per plot sampled in 1996). In 1995 and 1996, mechanically harvested seedcotton samples were ginned with a laboratory gin and the resulting lint samples were sent to Cotton Incorporated for HVI and AFIS analyses and additional testing. In 1997, lint for the Cotton Incorporated testing was collected at the Wilson Gin just before the bale press.

All plots were 127 ft wide (forty 38-inch rows or UNR equivalent) by approximately 430 ft long. All of the plot area was harvested, approximately 1.3 acres/plot, with no border area between plots. The study was designed as a randomized complete block with three replications. Fisher's least significant difference (LSD) was used to compare treatment means whenever significant (p values < 0.05) treatment effects were observed.

1995

The cultivar SUREGROW 404 was planted May 17. Aldicarb (Temik) was applied in-furrow at 3.5 lb a.i./acre. A grass-seeder attachment to the grain drill was used to apply the aldicarb to the UNR plots at the same per-acre rate as the conventional plots, resulting in a linear rate approximately one-fifth that of the conventional plots. To insure against excessive vegetative growth, two applications of 0.125 lb mepiquat chloride (Pix)/acre were made. Harvest aids were applied on October 7 (defoliant and boll opener) and October 21 (desiccant) and harvest was on October 25. Seedcotton was ginned on November 17 with one lint cleaner. Seedcotton was sufficient to produce two bales per plot.

1996

The cultivar SUREGROW 125 was planted May 21. Because of dissatisfaction with the aldicarb application method in 1995, imidacloprid- (Gaucho) treated seed was used in place of an in-furrow treatment. No mepiquat chloride was applied. Harvest aids were applied on October 9 (defoliant and boll opener) and October 20 (desiccant). However, frequent rains after the desiccant application delayed harvest until December 19, when the soil was frozen solid enough to support the equipment. Seedcotton was ginned on January 7, 1997 with two lint cleaners. Seedcotton was sufficient to produce one bale per plot.

1997

The cultivar SUREGROW 125 was planted May 6. Imidacloprid-treated seed was again used in place of an in-furrow treatment. No mepiquat chloride was applied. Harvest aids were applied on October 4 (defoliant and boll opener) and October 15 (desiccant), with harvest October 20. Seedcotton was ginned on November 25, 1997 with two lint cleaners. Seedcotton was sufficient to produce two bales per plot.

Results and Discussion

The relatively late planting and thus warm soils followed soon by rain the first two seasons led to high plant populations (Table 1). Less favorable conditions in 1997 led to much lower populations in both the conventional and UNR plots. Although not apparent from the data, the plants emerged over a much longer period of time in 1997. As expected, the UNR cotton plants were consistently shorter, with fewer nodes and fewer bolls per plant than the conventional (although the differences were not significant in 1996).

Seedcotton yield was higher from the UNR plots two of the three years (1995 and 1997; Table 2). However, part of the increase was offset by lower turnout, similar to the findings of Vories and Bonner (1995) for picked versus stripped cotton. In 1996, the year that harvest was delayed for nearly two months due to wet weather, more seedcotton was harvested from the conventional plots, although yield was low in both. It was not possible to estimate how much yield was lost due to the delayed harvest or whether the two production systems were equally affected. While the gin turnout in 1996 was not significantly affected at the alpha = 0.05 level, it was significantly affected at the alpha = 0.10 level. The lint yields shown were calculated from the separate turnout values and those lint values were used in the economic analysis.

None of the HVI parameters was significantly affected except for micronaire (Table 3). The UNR cotton had consistently lower micronaire than the conventional, although the difference was not significant in 1996. While higher trash content is a concern for stripped cotton, no significant differences in HVI trash values were observed. One of the bales from the UNR plots was discounted $0.02/lb for low-level bark in 1995 (data not included). The contamination was probably due to an area of grass that was heavy enough to stop up the header. The grass had been killed, but was still standing in the crop at harvest. No other stripped bales and none of the spindle-picked bales were discounted for bark.

As previously mentioned the samples for AFIS analyses in 1995 and 1996 were from a laboratory gin and may not adequately represent the UNR cotton being marketed. The 1997 samples were from the commercial gin. In 1997, the UNR cotton had significantly more neps, a higher short fiber content and more visible foreign matter than the conventional cotton (Table 4). The results in the previous two years were consistent with the 1997 results.

Finally, the UNR cotton in this study cost more to produce than the conventional (Table 5), due to higher seeding rates, thus higher seed and seed-treatment costs, and the inability to band herbicides. Omitting the seed treatment and spraying for thrips if necessary would have brought the UNR costs down. The breakeven prices for both systems were below the season average price (Ark. Agri. Stat. Serv., 1998) two of the three years, even after a 25% crop rent, suggesting a potential for profit. Questions about how UNR cotton will be marketed (e.g., whether there will be an automatic discount) must be answered to adequately address the economics of production.

The preceding economic analysis cannot address one important point regarding UNR cotton. The cost for a producer to bring cotton into his crop rotation may be much less in a UNR production system. A soybean producer, for example, may already have a good grain drill and broadcast sprayer. He may be able to avoid purchasing the bedders, cultivators, post-directed sprayers and other specialized equipment used in conventional cotton production.

Conclusions

As expected, the plants in the UNR system were shorter with fewer nodes and fewer bolls per plant than in the conventional system. Higher seedcotton yields were observed for UNR two of the three years, but lower gin turnout offset part of the increase. Of the HVI fiber properties, only micronaire was significantly affected, consistently lower for the UNR cotton. However, the AFIS analyses indicated more visible foreign matter, higher short fiber content and more neps associated with the UNR system. Production costs were higher for UNR cotton in this study, but omitting the seed treatment would have had a large effect on the UNR system's cost. Breakeven prices for both systems were below the season average price two of the three years, even allowing for a crop rent, suggesting a potential for profit. In addition, the cost to a producer to add cotton to a crop rotation may favor UNR cotton more than this analysis suggests.

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Table 1. Crop growth factors from UNR cotton study at NEREC, Keiser, Arkansas.

Production System	Parameter Value		
	-1995-	-1996-	-1997-
	Population (plants per acre)		
Conventional	41,000	49,000	28,000
UNR	150,000	149,000	82,000
LSD(0.05)	27,000	22,000	25,000
	Plant height (inches)		
Conventional	29.1	24.6	24.4
UNR	21.4	20.0	15.9
LSD(0.05)	3.4	n.s.	3.6
	Total nodes		
Conventional	19.6	18.7	22.0
UNR	17.5	15.5	17.2
LSD(0.05)	1.3	n.s.	1.4
	Bolls per plant		
Conventional	6.6	3.4	8.9
UNR	3.1	1.5	5.0
LSD(0.05)	1.5	n.s.	1.1

Table 2. Yield and gin turnout from UNR cotton study at NEREC, Keiser, Arkansas.

Production System	Parameter Value		
	-1995-	-1996-	-1997-
	Seedcotton yield (lb/acre)		
Conventional	2400	1440	2100
UNR	2770	1110	2800
LSD(0.05)	257	324	231
	Gin turnout (%)		
Conventional	32.2	30.8	36.0
UNR	27.9	28.1	30.9
LSD(0.05)	0.5	n.s.	2.2
	Lint yield (lb/acre)		
Conventional	773	443	756
UNR	773	312	867

Table 3. HVI fiber properties* from UNR cotton study at NEREC, Keiser, Arkansas.

Production System	Parameter Value		
	-1995-	-1996-	-1997-
		Micronaire	
Conventional	4.87	4.83	4.81
UNR	4.56	4.67	4.58
LSD(0.05)	0.18	n.s.	0.11
		Length (inches)	
Conventional	1.14	1.12	1.13
UNR	1.13	1.10	1.12
LSD(0.05)	n.s.	n.s.	n.s.
		Strength (g/tex)	
Conventional	31.6	26.8	28.1
UNR	31.8	25.3	27.8
LSD(0.05)	n.s.	n.s.	n.s.
		Uniformity (%)	
Conventional	84.0	82.3	81.8
UNR	83.2	82.0	81.8
LSD(0.05)	n.s.	n.s.	n.s.
		Trash (% area)	
Conventional	1.83	2.33	3.20
UNR	3.58	3.33	3.00
LSD(0.05)	n.s.	n.s.	n.s.

* HVI fiber analyses from samples provided by Wilson Gin to Memphis, TN Cotton Classing Office.

Table 4. Advanced fiber information system (AFIS) fiber properties from UNR cotton study at NEREC, Keiser, Arkansas.

Production System	Parameter Value		
	-1995*-	-1996*-	-1997*-
		Visible foreign matter (%)	
Conventional	6.27	4.12	0.64
UNR	9.90	7.73	1.02
LSD(0.05)	2.31	2.33	0.23
		Short fiber content (%)	
Conventional	2.03	9.2	4.48
UNR	2.70	10.7	5.72
LSD(0.05)	0.50	n.s.	0.53
		neps (per gram)	
Conventional	80	139	182
UNR	92	183	217
LSD(0.05)	n.s.	27	28

* 1995 and 1996 lint samples mechanically harvested and ginned with laboratory gin and no lint cleaning. 1997 lint samples collected from Wilson Gin after two lint cleaners.

Table 5. Economic properties from UNR cotton study at NEREC, Keiser, Arkansas.

Production System	Parameter Value		
	-1995-	-1996-	-1997-
		Total specified expenses ($/acre)	
Conventional	321	258	271
UNR	335	322	326
		BEP* over total expenses ($/pound)	
Conventional	0.42	0.58	0.36
UNR	0.43	1.03	0.38
		BEP over total expenses plus 25% crop rent ($/pound)	
Conventional	0.55	0.78	0.48
UNR	0.58	1.37	0.50
		Season average price** ($/pound)	
	0.734	0.707	0.661

* Breakeven price based on costs and yield.
** from Ark. Agri. Stat. Serv. (1998)