EVALUATION OF ULTRA NARROW COTTON PRODUCTION IN ARIZONA

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Abstract

Seven commercial ultra narrow row (UNR) cotton fields were monitored on a weekly basis in Maricopa County, AZ in 1999. Varieties of Delta Pine and Sure Grow were planted from April 15 to June 1 and reached cut-out after accumulating 1913 to 2327 heat units after planting. Average yield for UNR cotton was 2.1 bales per acre which was 0.4 bales per acre lower than the five year average for cotton planted on conventional row spacings. Fiber quality from gin records for 801 bales had average micronaire readings of 4.54 and grades of 11 and 21 for 74% of bales. Discounts for extraneous matter (bark, grass, and cracked seed) was 5.4% and average strength (34.8) and staple lengths (27.12) were in acceptable ranges. Total cash costs ranged from $450 to $705.

Introduction

Interest in ultra narrow row (UNR) cotton production in Arizona resulted in approximately 7,000 acres planted in 1999. However, little research or commercial experience with the production system is available in the state. The last experience with stripper harvested cotton and narrow rows was in the 1970's. Inability to control plant growth and weeds were major obstacles that were not overcome. The depressed cotton market and increasing cost of conventional cotton production leave producers with few options for producing a profitable crop. The UNR system has shown potential in the South and Southeast U.S. to reduce input costs while maintaining yield at or above yields obtained with conventional row spacings. These factors in combination with new plant growth regulators and transgenic herbicide resistant cotton varieties have prompted researchers and growers to reevaluate the UNR production system.

UNR cotton in Arizona was generally planted in laser leveled basins with an average row spacing of 10 inches. The expectation was to produce a few bolls per plant at high plant populations per acre with the objective of achieving an earlier than conventional crop. Replicated research trials comparing conventional and UNR production systems as well as preliminary weed control research were conducted in the state in 1999. The agronomic characteristics, inputs, yield and fiber quality of the crop were monitored in commercial fields throughout the season to evaluate potential benefits and challenges of UNR cotton production in Arizona.

Materials and Methods

During the 1999 growing season, seven commercial UNR cotton fields were monitored on a weekly basis in Maricopa County, AZ. Fields were selected based on planting dates ranging from April 15 to June 1 (Table 1). Each field was subdivided into four sections and five plants from each section were randomly selected for plant mapping once a week until irrigation termination. The data collected included plant height, total number of nodes, height to node ratio, first fruiting branch, nodes above white bloom (NAWB), and presence or absence of fruit at the first two positions on each fruiting branch. Plant mapping data were correlated with heat units accumulated after planting (HUAP) using 86 and 55° F thresholds (Brown, 1989) at each location using data from the nearest AZMET weather station. After defoliation, fields were sampled to determine final plant population, height, nodes, and harvestable bolls per plant. In addition, UNR cotton growing practices were observed to determine if and where input costs savings could be realized. Final yield and fiber quality were also evaluated, however the data was incomplete at time of press.

Results and Discussion

Plant Growth and Development

Earliest planting dates for UNR cotton were April 15 and 19 for Delta Pine (DP) 436 RR and Sure Grow (SG) 125 RR, respectively. Plant height at the time monitoring began was 19.7 inches for DP 436 RR and the first fruiting branch was at the fifth node. SG 125 RR plant height was 19.2 inches with the first fruiting branch was at the sixth node. Initially both varieties had relatively high (>79%) levels of fruit retention with DP 436 RR retaining more fruit early (Figure 1). However, at the four nodes above top white bloom (NAWB) (cut-out) stage, both varieties finished with approximately 50% fruit retention. DP 436 RR and SG 125 RR reached cut-out with 1955 and 1913 HUAP respectively.

Early May plantings of UNR cotton included DP 420 RR, DP 429 RR, and SG 125 BR. The first fruiting branch for DP 420 RR was at the fifth node while fruit was not present on DP 429 RR or SG 125 BR until the sixth node. Fruit retention was similar for DP 420 RR and SG 125 BR during the season and at cut-out when retention was nearly 60% (Figure 2). In contrast, cut-out was later and fruit retention was lower for DP 429 RR. Retention of first and second position fruit was no greater than 45% at irrigation termination for the three varieties.

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The latest planting dates monitored were May 18 and June 1 and were both planted with SG 125 BR. The May planting date produced the first fruiting branch at the sixth node while fruiting was delayed until the seventh node for the June planting. Fruit retention for both planting dates were high when monitoring began, however the June 1 planting date exhibited a sharp decrease in retained fruit starting at approximately 1800 HUAP (Figure 3). Final fruit retention at irrigation termination was 44% and 29% for the May 18 and June 1 planting dates, respectively.

Defoliation of UNR cotton occurred from 116 days after planting (DAP) for the April 19 planting date of SG 125 RR to 160 DAP for the June 1 planting date of SG 125 BR (Table 2). Plant populations were from 81,500 to 128,000 plants per acre. Final plant heights ranged from 24.5 to 33.6 inches with an average across planting dates of 14 fruiting branches and a range of 5.6 to 8.8 bolls per plant (Table 2).

Inputs

Grower reported cash costs including harvest and interest for UNR cotton in 1999 ranged from $450 to $705 per acre. It is important to note that several approaches were taken that resulted in this wide range of input costs. Lower growing costs were most often associated with minimum-till and no-till production practices in fields late-planted following a grain crop. The major cost reduction associated with UNR production was in water application. A range of 3.1 to 3.75 acre feet of water was used in contrast to a reported average of at least 6 acre feet for conventional cotton. Decreases in water applications were associated with shortening of the growing season and improved efficiency (flat borders versus furrow), not actual crop consumption. Additional savings resulted from decreased equipment and labor costs associated with the lack of cultivation and equipment passes over the field.

Cost increases in some areas of production were also noted. The use of plant growth regulators (PGR) was essential to maintain a compact plant for stripper harvest. Total PGR applications for the season ranged from 43 to 48 ounces product per acre in comparison to 0 to 16 ounces product per acre for conventional cotton. Chemical defoliation was also a challenge and resulted in one to two defoliant applications followed by a desiccant. Another input that resulted in increased cost was planting seed and ginning costs were increased by $0.20 per cwt. at some locations.

Yield and Fiber Quality

At this time, the complete results for yield and fiber quality are not available. However, county-wide yields for UNR cotton ranged from 1.15 to 3.35 bales per acre with an average of approximately 2.1 bales per acre and an average gin turnout of 31%. UNR cotton fiber quality also ranged widely from field to field depending on management practices and cotton variety (Table 3). High micronaire has become an increasing problem in conventional cotton production in Arizona. High micronaire was observed only in a small percentage of fields of UNR cotton this year, however, low micronaire was also observed in fields that were terminated too early. Reported staple lengths ranged from 33.7 to 35.8 (32^{nds}) and strength was 25.01 to 30.4 (gm/tex). Another concern for UNR cotton growers are discounts for extraneous material (bark, grass, and cracked seed). A low percentage (5.4) of the total number of bales harvested were discounted.

Summary

UNR cotton production in Arizona shows promise, however, there are many questions that still need to be addressed. A diversity of production practices were observed in the state with differing degrees of success. From an earliness standpoint, UNR cotton fields reached maturity at 1913 to 2327 HUAP. These values, for the most part, are on the early side of baselines established for early maturing cotton varieties on conventional row spacings (Silvertooth, 1998). However, fruit retention at maturity fell well below established baselines although the goal of setting five to six bolls per plant was met in the fields that were monitored.

Growing costs were also highly variable but in most cases were below that of conventional cotton with primary savings coming in water application and machinery costs. Average county-wide yields for UNR cotton were approximately 0.4 bales per acre less than the five year average for conventional cotton. Fiber quality looks promising for stripper harvested UNR cotton with micronaire values being lower than in conventionally produced cotton. Staple length, strength, color, and fiber uniformity were in the acceptable range and discounts for extraneous matter were relatively low.

Further research is needed to be conducted to determine appropriate varieties, options for improved full-season weed control, improved plant growth control, optimal stand densities, water and nutrient management, and thresholds for early season insect control. While 1999 results were promising, these and many other questions need to be addressed to determine the economic viability of UNR cotton production in Arizona.

References

Brown, P. W. 1989. Heat units. Bulletin No. 8915, University of Arizona Cooperative Extension, College of Agriculture, Tucson, AZ 85721.

Silvertooth, J. C. and E. R. Norton. 1998. Cotton monitoring and management system. Publication No. AZ1049, University of Arizona Cooperative Extension, College of Agriculture, Tucson, AZ 85721.

Table 1. Location, cotton variety, and planting date of UNR cotton fields monitored in Maricopa County, AZ, 1999.

Location	Variety	Planting Date (1999)
Buckeye, AZ	DP 436RR	4/15
Harquahala, AZ	SG 125RR	4/19
Buckeye, AZ	DP 420RR	5/1
Harquahala, AZ	DP 429RR	5/1
Harquahala, AZ	SG 125BR	5/7
Buckeye, AZ	SG 125BR	5/1
Palo Verde, AZ	SG125BR	6/1

Table 2. Number of days to defoliation , stand counts, plant heights, fruiting branches, and bolls/plant for UNR cotton in Maricopa County, AZ, 1999.

Variety	DAP[1]	Final Stand	Height	Fruiting Branches	Bolls
		#/A	in	#/plant	#/plant
DP 436RR	120	103,900	26.6	12.1	5.6
SG 125RR	116	108,500	27.2	13.5	6.0
DP 420RR	150	111,300	33.6	11.8	6.0
DP 429RR	132	93,400	28.9	14.6	6.1
SG 125BR	123	81,500	28.5	16.2	8.8
SG 125BR	119	88,400	24.5	12.6	8.8
SG 125BR	160	128,100	32.6	16.6	6.5

[1]DAP = days after planting to defoliation.

Table 3. Fiber quality measurements for UNR cotton in Maricopa County, AZ, 1999.

Variety	Bale	Grade (bale)	Stap. len.	Mic.	Ex. Mat.	Stren.
	#		32nds		%	gm/tex
SG 125BR	152	11(98), 21(53), 31(1)	34.0	4.67	0	26.21
SG 125BR	52	11(25), 21(27)	34.5	4.71	0	25.17
SG 125RR	52	11(33), 21(19)	33.7	4.41	0	25.01
SG 125RR	52	11(1), 12(23), 21(1), 22(27)	34.5	3.85	0	25.77
DP 5690RR	97	11(1), 21(87), 22(2), 31(5), 32(2)	35.1	5.02	1[1]	29.98
DP5690RR	88	21(45), 31(42), 32(1)	35.7	4.9	7[1,3]	30.4
DP 5415RR	20	11(6), 21(14)	35.8	4.32	5[1]	28.17
DP 5415RR	52	21(51), 31(1)	35.5	4.59	0	26.45
DP 429RR	36	11(11), 12(2), 21(19), 22(4)	34.3	4.45	5.5[2]	26.57
DP 436RR	96	12(16), 13(17), 22(33), 23(30)	34.7	3.45	24[1,3]	26.5
BXN 47	52	11(10), 21(42)	35.7	4.99	19[2]	26.73
BXN 47	52	11(4), 12(1), 21(43), 22(4)	34.5	5.02	0	26.46
Total	801	11(189), 21(401), 31(49), 12(42), 22(70), 32(3), 13(17), 23(30)	34.8	4.54	5.4	27.12

[1]Extraneous material rating 11 = bark
[2]Extraneous material rating 21 = grass
[3]Extraneous material rating 31 = cracked seed

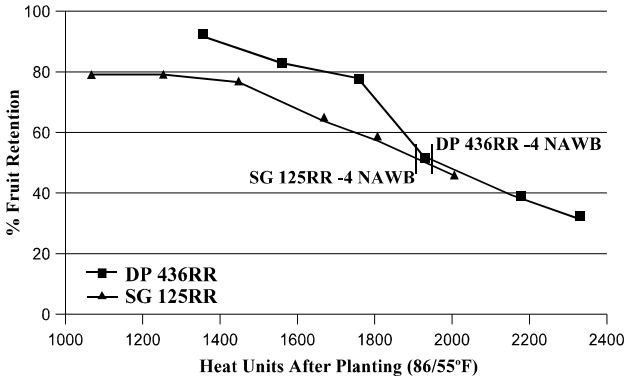

Figure 1. Fruit retention and cutout (indicated by vertical bars) as a function of HUAP for DP 436RR planted April 15 and SG 12RR planted April 19, 1999.

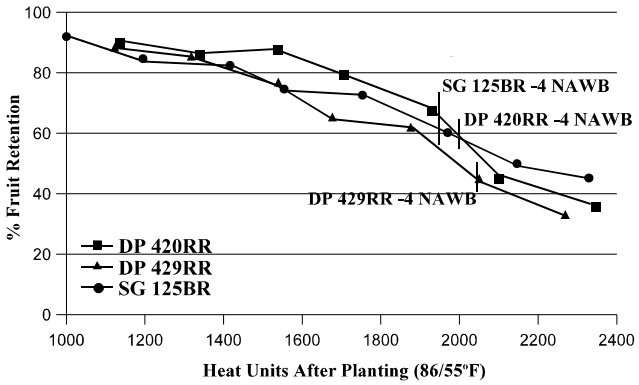

Figure 2. Fruit retention and cutout (indicated by vertical bars) as a function of HUAP for DP 420RR, DP 429RR planted May 1, and SG 125BR plant May 7, 1999.

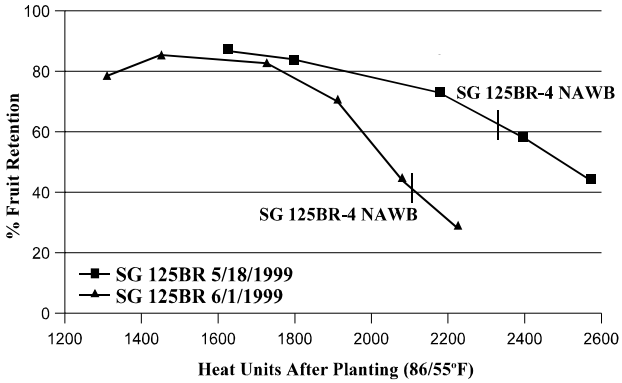

Figure 3. Fruit retention and cutout (indicated by vertical bars) as a function of HUAP for SG 125 planted May 18 and June1, 1999.