EVALUATION OF NARROW AND ULTRA NARROW COTTON IN ARIZONA

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Abstract

A field experiment was conducted in 2000 to evaluate narrow (30") and ultra narrow (10") row spacing cotton production systems. The study was conducted at a commercial farm located near Buckeye, AZ. The experimental design was a randomized complete block with three replications. The treatments included 10" row spacings that were harvested with a finger stripper, 30" row spacings harvested with a brush stripper, and 30" row spacings harvested with a spindle picker. Plant growth and development was not affected by row spacing throughout the growing season. No significant difference was observed for lint yield however, gin turnout was slightly lower for stripper harvested treatments. Fiber quality measurements were similar for both row spacing with the exception of fiber micronaire which was lower in stripper harvested treatments. Bark was a major problem with stripper harvested treatments with at least 92% of bales receiving a discount compared with 36% of spindle harvested bales.

Introduction

Interest in ultra narrow row (UNR) cotton production in Arizona resulted in approximately 7,000 acres planted in 1999 and 2000. The last experience with stripper harvested cotton and narrow rows was in the 1970's. Inability to control cotton growth and weeds were major obstacles that were not overcome. The depressed cotton market and increasing cost of conventional cotton production has left 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 those 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 in Arizona. Reported improved irrigation efficiency obtained by planting UNR cotton on the flat in laser leveled basins, prompted many growers to adopt the flat planted portion of the UNR production strategy in 2000. Both 30 and 38 inch row spacing cotton were planted with growers having the option of spindle pickicg the 30 inch row spacing cotton due to the negative perception of stripper harvested cotton.

Both 10" and 30" cotton were evaluated in replicated research trials comparing the production systems in Arizona in 2000. The agronomic characteristics and yield and fiber quality of the crop were monitored in commercial fields throughout the season to evaluate potential benefits and challenges of narrow and UNR cotton production in Arizona.

Materials and Methods

During the 2000 growing season, a replicated field experiment was conducted near Buckeye, AZ on William K. Perry Farms. The objective of the research was to compare agronomic characteristics 30" and 10" row spacing cotton production systems and to evaluate different harvest equipment for yield and fiber quality. The study design was a randomized complete block with three replications. Plot size was 83 feet by 1190 feet which was the length of the irrigation run. The soil type was a sandy loam and cotton variety DP 436 RR was planted dry on April 7, 2000. Germinating irrigation was applied on April 13, 2000. Ten inch row spacing plots were planted with a modified sled planter with a double tool bar equipped with JD71 Flex Planter units and 30" row spacings were planted with a modified sled with a single tool bar equipped with JD71 Flex planter units. Seeding rate was approximately 16 lbs/A for 30" row plots and 26 lbs/A for 10" row spacings. In-season management of the two systems were similar except for a post directed lay-by application of Caporol in the 30" row spacing treatments. Measurements included cotton height, first fruiting branch, total nodes, nodes above whit flower, and calculated fruit retention at the first and second position of five plants per plot every two weeks starting at fruit initiation and continuing through cutout (five nodes above white flower or less). After defoliation measurements included final population counts, plant height, total nodes, and bolls/plant. Cotton was harvested December 11 and 12, 2000 with a finger stripper (10" row spacing), brush stripper (30" row spacing), and a spindle picker (30" row spacing). Each plot was moduled separately, weighed, ginned, and cleaned out between treatments at the Valencia Gin near Buckeye, Arizona. Cotton grades and HVI testing were conducted by the USDA Cotton Classing Office in Phoenix, Arizona.

Results and Discussion

Cotton initiated the fruiting cycle at the sixth node for both the narrow and ultra narrow production systems. However, initial plant mapping indicated that overall fruit retention for 10" row spacing was 17% higher than the 30" row spacing (Figure 1). Two weeks later fruit retention was nearly identical for both the 10" and 30" row spacings and remained so throughout the season. No earliness advantage was observed for 10" rows over 30" row spacing systems with each reaching nodes above whit flower of five or less at approximately 2300 heat units after planting using an 86/55° threshold (Brown 1989). Height to node ratios were also very similar throughout the growing season (Figure 2). After defoliation cotton populations in the 20" row system were 60,600 plants per acre while the 10" row spacing had a population of 84,100 (Table 1). The 10" row spacing stand was lower than targeted, but still had fairly uniform plant spacing. No statistical differences were observed for plant height, total nodes, or the number of bolls produced per plant. No significant difference was observed for cotton lint yield with the 30" row spacing cotton harvested with a brush stripper yielding 1,936 lbs lint/A compared with 1,816 lbs/A for the 10" row spacing system (Table 2). Of interest, the 30" row spacing cotton harvested with the spindle picker yielded 218 lbs lint/A less than the brush stripper for the same row spacing. After the first application of defoliant, a killing frost occurred which resulted in a large number of desicated/stuck leaves. As a result commercial gin lint turnout was only 29.5% for spindle picker harvested cotton and no more than 27.9% for stripper harvested cotton. Cotton grades were predominately 31 for all three harvest scenarios (Table 3). Fiber micronaire was a high of 4.4 in the spindle harvested 30" row spacing and 3.7 for both row spacings that were harvested with a stripper. Staple, strength, and length were greatest in the 30" row spacing spindle picked treatments with only a slight drop off for stripper harvested plots. Extraneous material (bark) was present in 36% of bales harvest from 30" row spacing plots harvested with a spindle picker. Bark was a major problem for both the 10" and 30" row spacings harvested with a stripper type harvester with 92% and 100% of bales being discounted for bark respectively.

Summary

In summary both 10" and 30" row cotton performed similarly with respect to growth and development characteristics. The theoretical earliness advantage of ultra narrow row cotton (10") over wider row spacings was not observed in this experiment and has not shown to be of significance so far in other Arizona experiments as well as commercial operations. Cotton yields for both the 10" and 30" rows were excellent and no differences were

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observed between the two systems. However, it appears that the brush stripper may be more efficient in harvesting upper bolls that have not completely opened compared with the spindle picker. Fiber micronaire was lower for stripper harvested cotton in this experiment and in other ultra narrow row experiments in central Arizona. However, bark discounts were a major problem for stripper harvested cotton under the experimental conditions. At cutout, low fruit retention prompted the grower to pursue a top crop. While the overall benefit of increased yield was observed it did not result in ideal conditions for stripper harvested cotton. Other fiber quality measurements were similar for both stripper and spindle harvested cotton.

Establishment of a uniform population of around 100,000 plants per acre in ultra narrow row remains a critical issue for the success of the production system. Poor uniformity of stands coupled with lack of herbicides to control weeds emerging past the five true leaf stage of cotton make management of ultra narrow row cotton intense. If no advantage can be gained in earliness in the ultra narrow row system, a narrow row 30" system with the use of layby herbicides may be an attractive alternative for growers, especially with the option of spindle picker harvest.

References

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

Table 1. Plant population, final plant height, nodes, and bolls/plant for 10 and 30" row spacing cotton at Buckey, AZ, 2000.

Row Spacing	Population #/Acre	Height inches	Nodes	Bolls #/plant
10"	84,100	56.3	31	11.6
30"	60,600	53.7	31	12.8
LSD (0.05)	11,037	NS[1]	NS	NS

[1]NS= means are not significantly different (P<0.05) according to the LSD test.

Table 2. Cotton lint yield and commercial gin turnout for 10 and 30" row spacing cotton at Buckeye, AZ, 2000.

Row Spacing	Lint yield lbs/A	Turnout %
10" (finger stripper)	1816	27.9
30" (brush stripper)	1936	27.1
30" (spindle picker)	1718	29.5
LSD (0.05)	NS[1]	NS

[1]NS= means are not significantly different (P<0.05) according to the LSD test.

Table 3. Fiber quality measurements for 10 and 30" row spacing cotton in Buckeye, AZ, 2000.

Row Spacing	Grade	Mic.	Staple 32nds	Strength gm/tex	Ext. Mat. (% of bales)
10" finger	31	3.7	34.1	24.4	92
30' brush	31	3.7	34.2	25.6	100
30 spindle	31	4.4	34.9	27.1	36

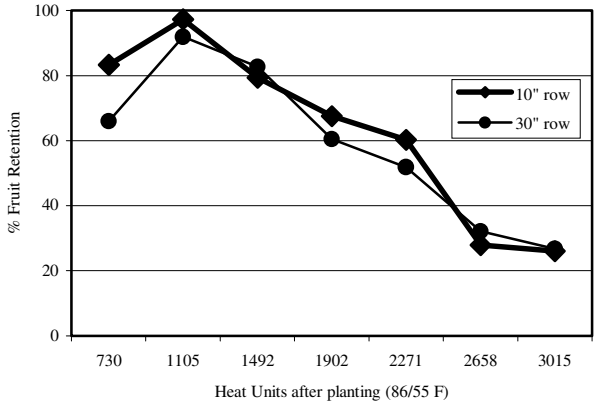

Figure1. Cotton fruit retention as a function of heat units accumulated after planting for 10" and 30" row spacings.

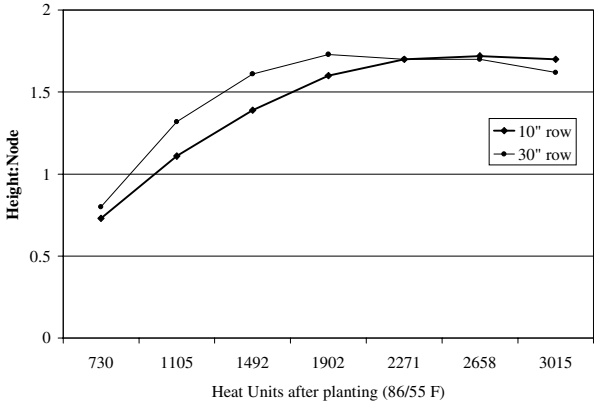

Figure 2. Cotton height: node ratio as a function of heat units accumulated after planting for 10" and 30" spacings.