ULTRA-NARROW ROW SYSTEM EFFECTS ON YIELD AND FIBER QUALITY OF A DWARF RED AND A NORMALLY-STATURED COTTON VARIETY

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Abstract

The dwarf red cotton (*Gossypium hirsutum* L.) variety CSA0107 B2RF (Monsanto Cotton States) has a growth habit that generally prevents canopy closure in conventional row (CR) spacings, suggesting that ultra-narrow row (UNR) systems would be advantageous to yield in this variety. The study objectives were to compare lint yield of both a red dwarf and a normally-statured cotton variety in a UNR and a CR system. The location was the LSU Agricultural Center's Northeast Research Station, Saint Joseph, LA. Each system was planted on a wide raised bed, with 4 rows (averaging 20 inches wide) per bed in the UNR treatments and 2 rows (40 inches wide) per bed in the CR treatments. Plant populations were elevated by approximately 50 percent in UNR treatments. Few treatment effects were observed on lint percentage and fiber quality. Lint yield was significantly decreased by the UNR system relative to the CR, although the difference between means was small. Lint yield was significantly and substantially lower for the dwarf red variety than for Stoneville 4554 B2RF. Despite the benefits of the UNR system to canopy closure in the dwarf red variety, the lint yield of each variety responded similarly to row spacing and the interaction between these factors was not significant. The data suggest that reduced lint yields of the dwarf red variety in CR systems may originate at least partially with factors other than a lack of canopy closure. The UNR system was not beneficial to yield in any variety.

Introduction

Row spacing and plant population effects have been widely studied in cotton. Each factor is altered in UNR production systems, which use row spacings of 20 inches or less and elevated plant populations. In several recent studies, lint yields in UNR relative to CR cotton have not differed (Clawson et al., 2006), have been elevated only inconsistently (Jost and Cothren, 2000, 2001), or under one set of circumstances have been reduced (Boquet et al., 2005). However, each of the above studies was conducted using normally-statured cotton that can usually achieve full canopy closure in conventional row spacings. Little information is available on the effects of a UNR system on lint yield of a dwarf variety.

The dwarf red cotton variety CSA0107 B2RF (Monsanto Cotton States), has a fruiting pattern that suggests high yield potential. However, its actual yield in conventional row spacings tends to be lower than that of normally-statured commercial cotton varieties. A reason for this may be underutilization of space because of its dwarf characteristic, suggesting the hypothesis that UNR systems would be advantageous to yield in this variety.

Objectives

Objectives are to compare lint yield of both a red dwarf and a normally-statured cotton variety in a UNR and a CR system.

Materials and Methods

The study was located at the LSU Agricultural Center's Northeast Research Station, Saint Joseph, LA. The study was designed as a randomized complete block with 8 replications; however, the randomization was manually adjusted to a Latin rectangle by ensuring that each treatment was repeated twice in each column crossing the original replications.

The two varieties used were CSA0107-B2RF (dwarf red) and Stoneville 4554 B2RF (normally statured). All treatments were planted on wide raised seedbeds, each 80 inches from furrow to furrow. Each plot was centered on one seedbed, and included half of a seedbed on each side for border rows. The UNR spacing averaged 20 inches, with four 16-inch rows per seedbed, 32 inches between rows on adjacent seedbeds, and 8 rows per plot. The CR spacing consisted of four 40-inch rows per plot, with two per seedbed. The test was planted on May 1, 2007. Seeding rates per acre were equivalent for all treatments. However, to fill in skips additional seed was jabbed on May 10. Stand counts on 14 Jun revealed elevated plant population in narrow row spacings (Table 1).

In UNR treatments one of the center rows and one of the outside rows on the center seedbed were picked (one-row picker). Using the same picker, both rows on the center seedbed were harvested in the CR treatments. Grab samples were taken from original replications 1, 3, 5, and 7, ginned, and analyzed for fiber quality at the LSU Cotton Fiber Laboratory.

The randomization reflected blocking in only one direction when the four grab-sampled replications were isolated, and data from the grab samples were analyzed as a randomized complete block using the Agricultural Research Manager program (Gylling Data Management, 2007). Lint percentages were averaged for each treatment before being used to convert seedcotton yields from all 8 replications to lint yields. Lint yield and plant population data were then analyzed as a Latin rectangle using proc mixed of SAS (SAS Institute, 2003).

Results

Plant populations were significantly higher (by approximately 50%) in UNR than in CR treatments (Table 1). An interaction between row spacing and variety was significant at the 10% level but did not appear to be meaningful (Fig. 1).

Full canopy closure was achieved by Stoneville 4554 B2RF regardless of row spacing. Canopy closure was not achieved by the dwarf red variety in CR spacing, but was partially achieved in the UNR spacing (the 32" spacing between beds was not fully closed, but canopy closure did occur in the 16" spacing between rows on the beds) (Figure 2).

Lint percentage was unaffected by treatments (Table 2). Fiber quality was mostly unaffected by treatments, with the most notable differences being greater fiber strength in the UNR system and lower values for elongation in the dwarf red variety.

Lint yield was significantly decreased by the UNR system relative to the CR, although the difference between means was small (Table 1). Lint yield was significantly and substantially lower for the dwarf red variety than for Stoneville 4554 B2RF. Despite the benefits of the UNR system to canopy closure in the dwarf red variety, the lint yield of each variety responded similarly to row spacing (Fig. 3), and the interaction between these factors was not significant. The data suggest that reduced lint yields of the dwarf red variety in CR systems may originate at least partially with factors other than a lack of canopy closure. The UNR system was not beneficial to yield in any variety.

Table 1. Plant population and lint yield, Saint Joseph, LA 2007.

Effect	**plant population**	**lint yield**
Row Spacing	**plants A^{-1}**	**lb A^{-1}**
narrow	58,234 a	991 b
wide	38,898 b	1,041 a
pr>F	***<.0001***	***0.04***
Variety		
CSA0107-B2RF (dwarf)	48,923 a	862 b
ST 4554-B2RF	48,209 a	1,170 a
pr>F	***0.69***	***<.0001***

Row Spacing by Variety Interaction		
narrow, CSA0107-B2RF	60358	831
wide, CSA0107-B2RF	37489	893
narrow, ST 4554-B2RF	56111	1151
wide, ST 4554-B2RF	40307	1189
pr>F	***0.06***	***0.60***

Means followed by a same letter do not differ by the Tukey-Kramer method at α=0.05

Table 2. Lint percentage and fiber quality, Saint Joseph, LA 2007.

Effect	lint %	length	uniformity	short fiber index	strength	elongation	micronaire	maturity
Row Spacing								
narrow	36.2%	1.11	83.09	6.07	29.50	9.98	4.74	85.6
wide	35.6%	1.09	82.76	6.63	28.78	10.00	4.83	85.7
pr>F	***0.13***	***0.08***	***0.12***	***0.02***	***0.03***	***0.85***	***0.24***	***0.64***
lsd(0.05)				***0.27***	***0.41***			
Variety								
CSA0107-B2RF (dwarf)	35.8%	1.10	83.00	6.63	28.54	8.83	4.78	86.4
ST 4554-B2RF	36.0%	1.10	82.85	6.06	29.74	11.15	4.79	84.9
pr>F	***0.34***	***0.54***	***0.20***	***0.07***	***0.07***	***0.00***	***0.88***	***0.01***
lsd(0.05)						***0.42***		***0.6***
Row Spacing by Variety Interaction								
narrow, CSA0107-B2RF	36.0%	1.10	83.10	6.49	28.51	8.85	4.70	86.3
wide, CSA0107-B2RF	35.5%	1.10	82.90	6.78	28.58	8.81	4.86	86.5
narrow, ST 4554-B2RF	36.3%	1.11	83.08	5.65	30.49	11.11	4.79	85.0
wide, ST 4554-B2RF	35.7%	1.09	82.63	6.48	28.99	11.19	4.80	84.9
pr>F	***0.90***	***0.20***	***0.39***	***0.54***	***0.12***	***0.78***	***0.17***	***0.32***

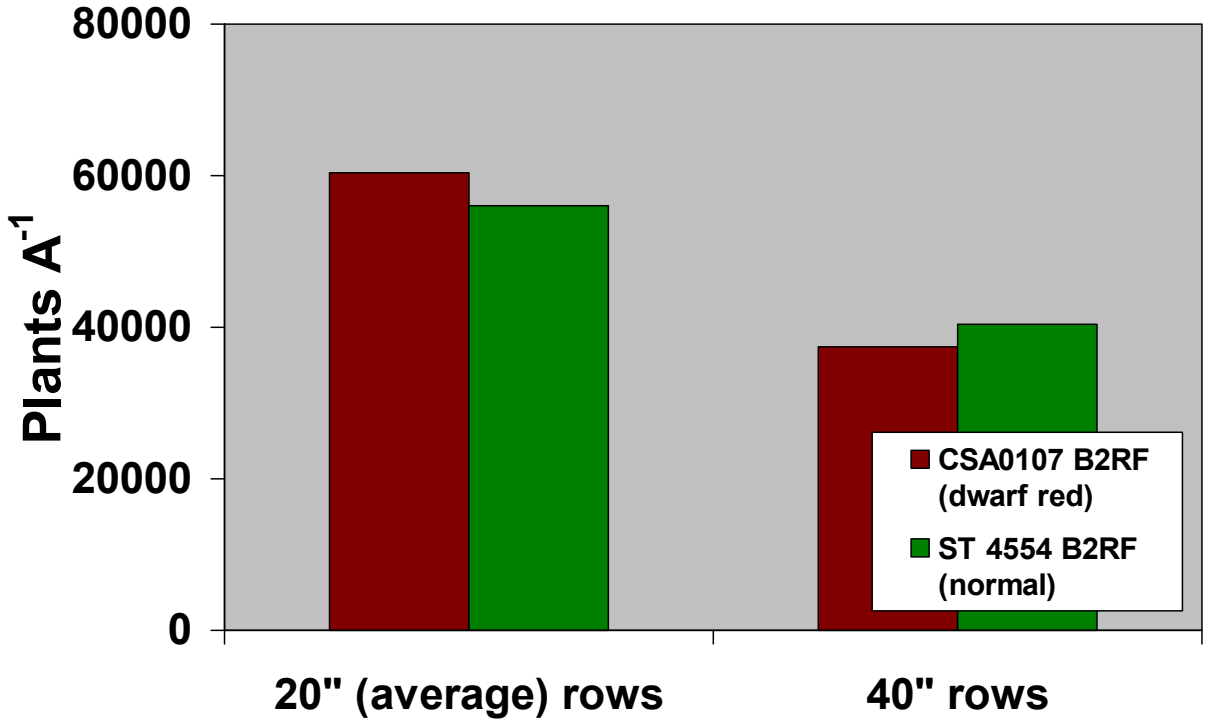

Figure 1. Plant population, Saint Joseph, LA 2007.

Figure 2. Photograph showing canopy characteristics, Saint Joseph, LA 2007.

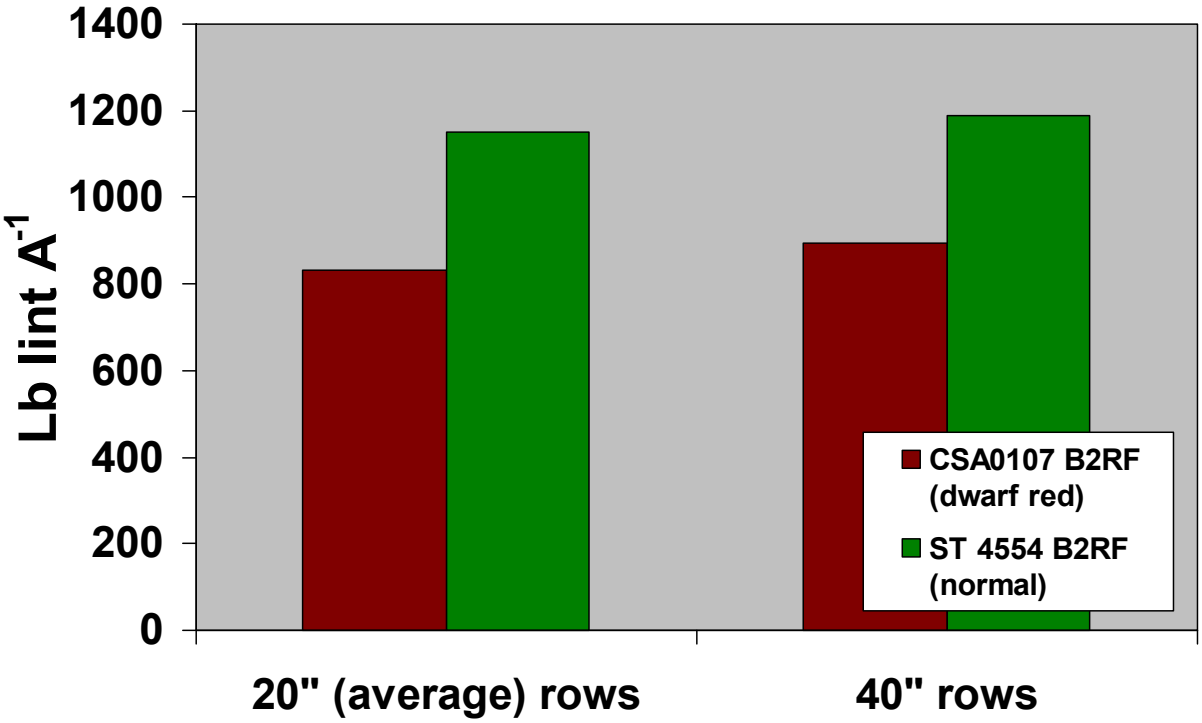

Figure 3. Lint yield, Saint Joseph, LA 2007.

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