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INTRODUCTION

Pricing of cotton (*Gossypium hirsutum* L.) has been determined primarily by fiber length and grade, which were manually determined. Implementation of the high volume instrument (HVI) cotton classing system in 1991 allowed other fiber quality parameters to be objectively and rapidly measured (Deussen, 1989). One quality parameter added to the pricing structure by the advent of HVI in determining the value of ginned lint is fiber strength (Table 1). Open-end spinning, a new technology being utilized by the textile industry, requires high-strength cotton fibers (>25 g/tex) for manufacture of yarns. As this technology becomes more widely used, cotton with weaker fiber strength will become less desirable, and cotton grown in Arkansas may become less preferred by textile mills, thereby damaging the cotton production industry of Arkansas.

Environmental and processing factors are known to influence fiber properties. Micronaire, a measure of the fineness of cotton fiber, varies greatly with environmental and production conditions but only slightly among cotton cultivars adapted to the Mississippi River Delta. Grade, based on color, trash content and gin preparation, is primarily determined by conditions and practices near and during harvest. Fiber length uniformity may be affected by the lint cleaning process and excessive ginning. Yellowness is increased by excessive exposure to moisture after harvest or high ginning temperatures. Poor reflec-

Table 1. Fiber strength ranges for discounts and premiums paid for cotton lint fiber.*

Fiber Strength (g/tex)	Premiums/Discounts
< 19	Not eligible for government loans
19 - 23	Graduated discounts
24 - 25	Base rate
26 - 30	Graduated premiums
> 30	Level premiums

*Mace, 1989.

tance or grayness of fibers may be due to fungal growth on the fiber induced by field weathering (Mayfield, 1991; Meredith, 1991).

Cotton cultivars differ in growth characteristics such as height, fruit development, drought tolerance, maturity and earliness, yield potential and many fiber properties (Niles and Feaster, 1984). The length and strength of cotton fibers are primarily determined by genetics of the cultivars and, therefore, may be manipulated by producers through cultivar selection (Meredith, 1991). Lint from different bales of cotton is frequently combined and blended at textile mills to achieve certain desired properties of spun yarns. The bales may be from diverse locations and consist of several cultivars (Perkins et al., 1994). Arkansas producers could potentially plant and grow blends of seeds of different cotton cultivars to increase the value of their lint to textile mills.

The objectives of this study were to evaluate yield, earliness and fiber strength of cotton grown from blends of seed from high-strength cultivars and a cultivar adapted for high yield and earliness under Mississippi River Delta production conditions.

MATERIALS AND METHODS

Yield, earliness and fiber strength of cotton grown from blends of seed from two high-strength cultivars with a cultivar adapted for Mississippi River Delta production conditions were studied during 1990 and 1991 at three locations. The two high-strength, Acala-type cultivars were 'Deltapine 90' (DPL 90) and 'HyPerformer 46' (HS 46). The cultivar adapted for high yield and earliness under Arkansas production conditions was 'Deltapine 50' (DPL 50). Ratios of either DPL 90 or HS 46 to DPL 50 used in these experiments were based on seed number. The fraction of high-strength cultivar (either DPL 90 or HS 46) blended with DPL 50 was either 0%, 25%, 50%, 75% or 100%.

The three test locations were the Northeast Research and Extension Center at Keiser, Arkansas (NEREC); the Cotton Branch Station at Marianna, Arkansas (CBS); and the Southeast Branch Experiment Station near Rohwer, Arkansas (SEBES). The soils at the sites are Sharkey silty clay (very fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts) at NEREC; Loring silt loam (fine silty, mixed, thermic Typic Fragiudalfs) at CBS; and Hebert silt loam (fine silty, mixed, thermic Aeric Ochraqaulfs) at SEBES. The seed blends were tested in a randomized complete block design with four replications at each test location. The tests were conducted under both furrow-irrigated and dryland production conditions at all three locations. Since the irrigated and dryland tests were physically separated at each test location, the two irrigation treatments were considered as separate locations in the statistical analysis of the data.

Plant characteristics studied as a function of the seed blends of the cultivars included seedcotton yield, earliness and fiber strength. Seedcotton yield was determined by harvesting each plot twice with a spindle cotton picker. Plots were harvested the first time when the test averaged 80% open bolls and harvested the second time approximately two weeks later. The fraction of the total seedcotton picked during first harvest was used to calculate the percent first harvest (PFH), an estimate of earliness. Samples of seedcotton were taken from all blends of two replicates at each location. The strength of the fiber from each seed blend was determined using HVI technology from the first harvest.

All data were analyzed using the Statistical Analysis System-1994 version 6.08. The F-test of the experimental variables was considered significant at $\alpha = 0.05$ level. Means of variables were separated using Fisher's Least Significant Difference (LSD), also at $\alpha = 0.05$.

RESULTS AND DISCUSSION

Seedcotton Yield of Cultivars and Blends

Seedcotton yields of the cultivars and their blends were found to significantly differ under irrigated conditions at NEREC and CBS in 1990 and at CBS in 1991 (Table 2). The 100% DPL 50 had the greatest mean yield at NEREC and CBS in 1990 and at CBS in 1991, although not always significantly greater than some of the blends. Yields observed at NEREC in 1991 and at SEBES both years were tightly grouped with few trends evident, although 100% DPL 50 was the highest yielding cultivar/blend at NEREC and second highest yielding at SEBES in 1991. Yields of blends at NEREC tended to be intermediate to their component cultivar each year. The NEREC and CBS sites are located in northern Arkansas where a delay in maturity is more likely to occur than at SEBES. Delays in maturity may have reduced yields of the late-maturing cultivars and blends more at NEREC and CBS than at SEBES.

No significant yield differences were observed under dryland conditions at any location either year of the study (Table 2). The yields in dryland tests were tightly grouped similarly to the irrigated cotton yields at SEBES and the yields at NEREC in 1991. Apparently the expression of individual cultivar characteristics, such as yield, was minimized by the lack of supplemental water from irrigation.

Yields in the irrigated tests were greater than yields in the dryland tests at each location both years (Table 2). Yield increases attributed to irrigation ranged from a minimum of 15.3% at SEBES in 1991 to a maximum of 93.7% at CBS in 1991. The mean yield increase due to irrigation across locations was 42.0% in 1990 and 43.4% in 1991. Variation in yield differences due to irrigation was much greater in 1991 than in 1990, although the reason is not apparent.

Earliness of Cultivars and Blends

Significant differences in PFH were only observed at the NEREC location under irrigated and dryland conditions in 1990 and under irrigated conditions in 1991 (Table 3). No other significant differences were observed, although trends at certain locations were similar to those observed at NEREC. The

Table 2. Seedcotton yield of 'Deltapine 50' (DPL 50), 'HyPerformer 46' (HS 46), 'Deltapine 90' (DPL 90) and six seed blends (seed number : seed number) grown under furrow-irrigated and dryland conditions at three locations.

Cultivar/Blend			Yield						
			Irrigated			Dryland			
DPL90	DPL50	HS46	NEREC*	CBS	SEBES	NEREC	CBS	SEBES	Mean
---------- % ----------			------------------------------- lb seedcotton/acre ------------------------------						
					1990				
100	0	0	2044	2262	3627	1601	1447	2923	2355
75	25	0	2142	2447	3847	1717	1699	2719	2460
50	50	0	2294	2512	4084	1986	1675	2456	2537
25	75	0	2341	2646	3708	1902	1675	2622	2518
0	100	0	2770	2701	3901	1764	1665	2445	2579
0	75	25	2327	2530	3890	1833	1646	2552	2499
0	50	50	2421	2545	3751	1742	1481	3047	2542
0	25	75	2461	2385	3412	1666	1704	2816	2421
0	0	100	1757	2207	4245	1710	1409	2655	2370
LSD $_{(0.05)}$			500	265	NS	NS	NS	NS	NS
Mean			2284	2470	3830	1769	1600	2689	
LSD $_{(0.05)}$=241†									
					1991				
100	0	0	3115	2861	3806	2218	1804	3775	2893
75	25	0	2904	2915	3989	2305	1445	3582	2857
50	50	0	2850	3104	3966	2516	1463	3227	2854
25	75	0	2890	3267	4259	2523	1594	3284	2969
0	100	0	3151	3489	4058	2534	1677	3072	2997
0	75	25	3071	3124	3966	2468	1503	3129	2877
0	50	50	2966	2991	3789	2556	1369	3479	2858
0	25	75	3020	2940	3743	2613	1456	3399	2862
0	0	100	2868	2621	3582	2403	1793	3722	2793
LSD$_{(0.05)}$			NS	322	NS	NS	NS	NS	173
Mean			2981	3035	3906	2460	1567	3388	
LSD$_{(0.05)}$=148†									

*NEREC = Northeast Research and Extension Center, Keiser, Arkansas; CBS = Cotton Branch Station, Marianna, Arkansas; SEBES = Southeast Branch Experiment Station, Rohwer, Arkansas.

† Least significant difference (α =0.05) for comparing test and location means.

Table 3. Percent first harvest based on seedcotton yields of 'Deltapine 50' (DPL 50), 'HyPerformer 46' (HS 46), 'Deltapine 90' (DPL 90) and six seed blends (seed number : seed number) grown under furrow-irrigated and dryland conditions at three locations.

Cultivar/Blend			Yield						
			Irrigated			Dryland			
DPL90	DPL50	HS46	NEREC*	CBS	SEBES	NEREC	CBS	SEBES	Mean
---------- % ----------			-------------------- % --------------------						
					1990				
100	0	0	69.3	80.8	92.9	83.6	88.3	93.6	84.6
75	25	0	69.3	79.1	91.3	86.9	88.7	90.5	84.1
50	50	0	78.5	82.8	93.8	88.0	88.1	91.6	87.1
25	75	0	80.4	83.9	94.3	90.4	89.3	94.0	88.7
0	100	0	82.2	86.5	94.9	91.7	90.6	92.5	89.7
0	75	25	81.7	84.5	94.2	87.9	90.0	91.9	88.3
0	50	50	75.1	82.5	94.1	89.8	88.2	94.4	87.3
0	25	75	77.5	79.4	94.5	84.4	89.1	94.7	86.1
0	0	100	73.2	81.2	94.9	82.5	88.6	94.6	85.7
$LSD_{(0.05)}$			5.5	NS	NS	3.8	NS	NS	NS
Mean			76.4	82.3	93.9	87.2	89.0	93.0	
$LSD_{(0.05)}$=2.7†									
					1991				
100	0	0	86.5	83.7	85.3	93.8	100‡	87.7	89.6
75	25	0	82.8	82.2	84.2	94.0	100	91.3	89.1
50	50	0	79.8	85.1	85.3	95.3	100	92.0	89.6
25	75	0	83.6	89.2	84.5	95.6	100	92.2	90.9
0	100	0	87.1	90.1	87.8	94.6	100	92.6	92.0
0	75	25	86.6	84.4	86.2	96.5	100	89.7	90.6
0	50	50	85.8	87.1	85.8	92.5	100	90.8	90.3
0	25	75	80.1	86.7	85.4	93.7	100	93.4	89.9
0	0	100	73.3	79.4	87.2	95.3	100	90.5	87.5
$LSD_{(0.05)}$			7.0	NS	NS	NS	NS	NS	1.9
Mean			82.8	85.3	85.7	94.6	100	91.3	
$LSD_{(0.05)}$=3.0†									

*NEREC = Northeast Research and Extension Center, Keiser, Arkansas; CBS = Cotton Branch Station, Marianna, Arkansas; SEBES = Southeast Branch Experiment Station, Rohwer, Arkansas.

† Least significant difference (α =0.05) for comparing test and location means.

‡ Plots were not picked a second time due to a lack of harvestable seedcotton after first harvest.

dryland test at CBS in 1991 was harvested only once. The PFH of 100% DPL 50 was greatest of all cultivars and blends tested under irrigated conditions both years. The Acala-type cultivars tended to be later maturing and have a lower PFH than the blends or DPL 50, but differences were rarely significant. Percent first harvest for the dryland tests at CBS and SEBES in 1990 and all locations in 1991 were high and tightly grouped.

Significant differences in the PFH averaged across all locations were observed in 1991. Observed trends in PFH across locations were similar to the trends in the irrigated tests. Deltapine 50 had a significantly greater PFH than either DPL 90 or HS 46. The blends with greater Acala-type components tended to have lower PFH.

Percent first harvest was significantly lower in irrigated tests than in the dryland tests at all locations both years except SEBES in 1990. Delayed maturity and increased yields as a consequence of irrigation have been reported for cotton in other studies (McConnell et al., 1993; Orgaz et al., 1992).

Fiber Strength of Cultivars and Blends

Fiber strength of the irrigated cultivars and blends was found to be significantly different at all locations in 1990 and at SEBES in 1991 (Table 4). Highest strength was observed in the Acala-type cultivars, while lowest strength was associated with DPL 50 when results were statistically significant. HyPerformer 46 and DPL 90 did not significantly differ in fiber strength. Blends of cultivars were usually intermediate in fiber strength compared to DPL 50 and the two Acala-type cultivars. Generally, the greater the fraction of Acala-type cultivar in the blends, the greater the strength of the fiber, although not all differences were significant, and some reversals of this trend were observed. The disproportional fiber strength to Acala content ratio of the blend may have been due to differences in yield between the Acala plants and the DPL 50 plants in the blend.

In dryland culture, the cultivars and blends exhibited significant differences in fiber strength at all locations and years except CBS in 1991 (Table 4). Trends in fiber strength for the cultivars and blends were similar to those observed in the irrigated tests, but more reversals in fiber strength were observed.

Fiber strength averaged across cultivars and blends was similar among irrigated and dryland tests at each location. Fiber strength was slightly lower in the irrigated tests compared to the dryland tests; however, differences were small and non-significant.

Table 4. Fiber strength of 'Deltapine 50' (DPL 50), 'HyPerformer 46' (HS 46), 'Deltapine 90' (DPL 90) and six seed blends (seed number : seed number) grown under furrow-irrigated and dryland conditions at three locations.

Cultivar/Blend			Yield						
			Irrigated			Dryland			
DPL90	DPL50	HS46	NEREC*	CBS	SEBES	NEREC	CBS	SEBES	Mean
---------- % ----------			-- g/tex --						
					1990				
100	0	0	30.8	30.9	29.5	30.5	24.6	28.4	29.1
75	25	0	28.7	27.9	28.5	28.7	26.3	25.4	27.6
50	50	0	26.5	25.8	26.5	24.6	25.9	24.6	25.6
25	75	0	26.2	24.1	25.1	25.3	25.0	24.6	25.0
0	100	0	24.3	23.5	24.0	25.4	23.8	23.5	24.1
0	75	25	25.6	23.2	24.4	27.0	24.7	25.4	25.0
0	50	50	26.9	26.8	26.3	27.4	29.6	23.9	26.8
0	25	75	28.8	27.5	27.3	28.6	30.3	24.5	27.8
0	0	100	29.8	26.9	29.4	29.0	26.8	28.9	28.4
LSD $_{(0.05)}$			1.8	3.7	2.9	2.0	3.3	3.3	1.1
Mean			27.5	26.2	26.7	27.4	26.3	25.4	
LSD $_{(0.05)}$=NS†									
					1991				
100	0	0	27.6	24.9	28.9	28.8	24.7	29.5	27.8
75	25	0	27.8	25.9	26.5	25.4	25.8	27.9	26.7
50	50	0	26.6	24.7	26.8	27.5	26.6	27.9	26.9
25	75	0	26.5	24.6	25.5	25.6	24.5	26.1	25.5
0	100	0	26.2	24.0	23.5	25.6	26.6	24.5	24.8
0	75	25	26.9	26.1	26.1	25.8	28.5	25.8	26.4
0	50	50	25.4	26.7	26.6	28.9	27.1	28.5	27.3
0	25	75	27.6	27.3	26.8	29.1	24.8	28.7	27.5
0	0	100	27.5	26.4	29.2	27.6	25.3	27.9	27.6
LSD$_{(0.05)}$			NS	NS	2.0	1.9	NS	2.3	1.1
Mean			26.9	25.6	26.6	27.1	26.0	27.4	
LSD $_{(0.05)}$=NS†									

*NEREC = Northeast Research and Extension Center, Keiser, Arkansas; CBS = Cotton Branch Station, Marianna, Arkansas; SEBES = Southeast Branch Experiment Station, Rohwer, Arkansas.

†Least significant difference (α =0.05) for comparing test and location means.

CONCLUSIONS

Seed blends of high-fiber-strength, late-maturing cultivars (HS 46 and DPL 90) with an early maturing, high yielding cultivar (DPL 50) were tested at three locations in Arkansas for two years. The objective was to determine if fiber strength of a cotton crop may be increased through the production of cultivar blends. Secondary objectives were to determine the effect of cultivar blends on yield and earliness relative to a cultivar (DPL 50) adapted to Arkansas. Little difference was observed between the two high-strength cultivars, HS 46 and DPL 90. Generally, yield, maturity and fiber strength of the blends were intermediate to their respective component lines when the components differed substantially. High-strength cultivars and blends tended to yield less and mature later than DPL 50 under irrigated production conditions. The cultivar blends were more likely to exhibit increased fiber strength without reducing lint yield in dryland culture (five of six tests) and at the southern-most location of these experiments. The economic value of blending cultivars will depend on the price premium for fiber strength offset by production costs and potential yield loss.

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