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BREEDING AND GENETICS

Effect of Cultivar Blends on Fiber Quality, Lint Yield, and Gross Return of Upland Cotton in West Texas

E. Bechere*, A. Alexander, D.L. Auld, and C.P. Downer

ABSTRACT

During the years 2001 and 2002, field trials were conducted to study the effect of blending different cotton cultivars on fiber quality, lint yield, and lint yield stability across environments. Four commercial cultivars were used. Two cultivars developed by Texas Tech University, 'Raider 271' and 'Raider 202', have excellent fiber quality but lower lint yield potential. Two other cultivars, Delta and Pine Land 'DP 2379' and Associated Farmers Delinting 'AFD-Explorer', have lint yield potential but lower fiber quality. The cultivars had similar seed sizes and were combined by volume (volumetric), pairing the high fiber quality cultivars with the high yielding cultivars in five different ratios, 0:100, 25:75, 50:50, 75:25, and 100:0. In 2001, the blends were evaluated in Lubbock and New Deal, TX, under irrigated and dry land conditions, respectively, and in 2002 at Lubbock under irrigated conditions for HVI fiber quality, lint yield, and gross return. Each plot was replicated four times using a randomized complete block design. Under both irrigated and dry land conditions, the yields of the blends were intermediate between the low and high yielding cultivars. Blending had no effect on fiber strength, but uniformity was reduced by blending. In general, the blends improved fiber length, but they did not generate a significant economic gain as estimated by the gross return values of the blends. Some blends showed better stability and adaptation across environments compared with their components. This was more apparent under irrigated conditions.

There is an increased emphasis on growing cotton cultivars with fiber quality that meets or exceeds the minimal standards of the export market. The shorter fiber length of cotton cultivars grown across the Texas High Plains have historically limited the price received in both domestic and international markets. To be considered as "Export Class A", a bale must have an HVI analysis in which micronaire is between 3.5 and 4.9, staple length is 35 or greater, and a minimum strength is 26 cN/tex (Hequet and Ethridge, 2005). Cotton failing to meet these standards is sold at substantial discounts in foreign markets. The average staple length of the 6.0 million bales of cotton grown in the Southwest (Texas, Oklahoma, and Kansas) in 2006 was only 35.8 mm and average fiber strength was 28.6 cN/tex (Cotton Incorporated, 2006). Cultivars with improved fiber quality must be developed or cotton grown in this region will be severely penalized in the highly competitive international markets. Low fiber quality cultivars and the associated price discounts have led to an interest in the potential of mixing different cultivar to maintain yield and improve fiber quality.

In cotton, blending seeds of different cultivars to achieve specific fiber quality was examined by Simpson and Fiori (1974). The effects of mixing seed from cotton cultivars that were different in micronaire had no effect on strength, strength variability, uniformity, or end breakage. Planting cotton seed mixtures of two cultivars has also been examined for its effect on insect pests (Agi et al, 2001; Durant, 1995). In general, mean percentage of larval infestation and mean percentage of damaged fruits increased as the percentage of *Bt* seed in the blends decreased. In five experiments at three sites in Uganda, mixtures of numerous Upland cultivars did not exceed yields of individual cultivars (Innes, 1977). Bridge et al. (1984) found that mixing two cultivars with similar yield potential, Stoneville 825 and Deltapine DP41, did not result in higher lint yield or staple length, but did increase micronaire and lint strength. In Arkansas, seed of 'Deltapine 50' blended with 'Deltapine 90' or Paymaster 'Hyperformer 46' increased strength values above monocultures of Deltapine 50 (McGonnel et al., 1991). Dobbs et al. (2007) conducted a study to determine if Paymaster PM 1218 BG/RR, a cultivar

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with micronaire values in the discount range, and DP 451 BG/RR, a cultivar with micronaire values in the non-discount range, could be grown together to produce high yields and avoid high micronaire discounts. There were no differences between locations and only minor differences in fiber quality between treatments and years. DP 451 BG/RR alone and in blends with PM 1218 BG/RR showed increased fiber lengths compared with PM 1218 BG/RR alone. In an attempt to determine if overall fiber quality could be improved by blending early-maturing, high yielding cultivars with cultivars with high quality, Craig and Gwathmey (2003) blended three high-yielding, stacked-gene cultivars, DP 451 BG/RR, FiberMax FM 989 BR, and Deltapine DP 555 BR. They suggested that blending cultivars may offer a temporary solution to fiber quality problems, but factors, such as crop maturity differences and ginner reluctance, must be considered. Faircloth et al. (2003) concluded that mixtures of cotton cultivars offered at most, a short-term approach to improving fiber quality. The best solution, according to them, to avoid fiber quality discounts was to focus research on traditional breeding efforts aimed at developing cultivars with high lint yields and superior fiber quality. They did, however, find gains in lint yield and fiber quality with selected cultivar mixtures. Poehlman and Sleper (1995) have pointed out that a blend of genotypes could yield consistently higher than the average of the pure component genotypes because the buffering effect against genotype by environment interactions could be more stable over locations and years than a pure line cultivar.

The first objective of this research was to compare lint yield and fiber quality of conventional cotton cultivars planted in seed mixtures aimed at achieving optimal fiber quality without sacrificing yield potential on the Texas High Plains. The second objective was to test the stability of these seed mixtures and their component cultivars across environments.

MATERIALS AND METHODS

This study was conducted during 2001 and 2002 across five environments, Lubbock irrigated (2001 and 2002), New Deal irrigated (2001), Lubbock dry land (2001) and New Deal dry land (2001). Treatments consisted of four monocultivar treatments, 100 % each of Raider 202 (Texas Tech University; Lubbock, TX), Raider 271 (Texas Tech University), DP 2379 (Delta Pine and Land Co.; Scott, MS) and AFD-Explorer (Associated Farmers Delinting Co.; Littlefield, TX) and 25/75, 50/50, and 75/25 percentage mix by volume (volumetric) of these cultivars. The cultivars were very similar in seed size and maturity. Raider 202 and Raider 271 represent superior fiber quality properties, while DP 2379 and AFD-Explorer represent high yield potential cultivars. The planting date, harvest date, plot size, total precipitation, and amount of irrigation water applied to the irrigated experiments is provided in Table 1. Plots consisted of four replications of double rows grown in a randomized complete block design with 101.6-cm (40-in) spacing between rows. Seeding rates at all locations were 17 seed per row meter (5 seeds per row foot). The nurseries were weeded and fertilized as needed, and in 2001 they were sprayed with malathion (Drexel Chemical Co.; Memphis, TN) by the Texas Boll Weevil Eradication Service. The experiments were also planted with 3.6 kg/ha (3 lb/a) of aldicarb (Temik 15G; Bayer CropSciences; Research Triangle Park, NC) and trifluralin (Treflan; Dow AgroSciences), a pre-emergent herbicide, at 1.75 L/ha at 206 kPa. Seed cotton yield was determined by mechanically harvesting each plot with a stripper. Sub-samples from each plot (about 500 grams) were ginned on a 20-saw gin to determine lint yield. Fiber samples were analyzed using high-volume instrumentation (HVI) analyses by the International Textile Center at Texas Tech University. Discount levels are based on the 2001 USDA government loan program. Analyses of variance were performed on all harvest data including lint yield, micronaire, staple length (UHM), uniformity index (UI), elongation, fiber strength, and

Table 1. Planting date, harvest date, plot size, and cumulative rainfall for each year and location

Location	Year	Planting date	Harvest date	Plot size (m)[z]	Cumulative rain (cm)	Irrigation (cm/ha)
Lubbock Irr.	2001	16 May	15 Oct.	10.6	45	15
Lubbock Dry	2001	22 May	15 Oct.	10.6	45	--
New Deal Irr.	2001	11 May	24 Oct.	10.6	43	15
New Deal Dry	2001	11 May	24 Oct.	10.6	43	--
Lubbock Irr.	2002	14 May	18 Oct.	9.1	53	10

[z] All plots consisted of two rows.

gross return using the SAS program (release 6.12; SAS Institute; Cary, NC). Means were separated using Fisher's protected LSD at $P = 0.05$. The method developed by Eberhart and Russell (1966) was used to estimate stability of the cultivars and their blends.

RESULT AND DISCUSSION

The results of the analysis of variance for all tested parameters across the three irrigated environments are given in Table 2. Blending of cultivars had significant effects on micronaire readings, fiber length, fiber uniformity, elongation, lint yield, and gross return. Fiber strength was not affected by cultivar blends. Location effects were significant for lint yield and gross return. The blend by location interactions were significant for fiber length, lint yield, and gross return. The data across the three irrigated environments are combined and presented in Table 3. In general, micronaire for the blends were significantly higher than for the monocultures. Fiber uniformity was significantly higher for monoculture

Table 2. Mean square values for all parameters tested across three irrigated environments at Lubbock (2001 and 2002) and New Deal (2001)

Source	df	Parameter[z]						
		Micronaire	Fiber length	Uniformity	Fiber strength	Elongation	Lint yield	Gross return
Blend	19	1.75*	0.01**	19.20**	4.70	3.43*	47440**	12963**
Replication	3	0.47	0.001	2.73	0.74	0.92	1798	338
Blend x Rep.	57	0.41	0.001	1.26	2.82	1.16	9171	2562
Location	2	0.61	0.002	0.88	0.10	2.38	715623**	210360**
Blend x Loc.	38	0.26	0.004**	1.93	4.39	2.21	18457**	4566**
Error	120	0.34	0.002	1.54	3.46	1.72	7838	2352

[z] Values followed by * and ** are significantly different at the $P \leq 0.05$ and $P \leq 0.01$, respectively.

Table 3. Mean fiber quality parameters for cultivars and cultivar blends grown at Lubbock (2001 and 2002) and New Deal (2001) under irrigated conditions

Cultivar/blend	Micronaire[z]	Uniformity (%)[z]	Strength (cN/tex)	Elongation
DP 2379	4.6 a-e	84.1 a	30.5	8.7
Raider 202(25)/DP 2379(75)	4.9 a	82.5 def	31.2	8.1
Raider 202(50)/DP 2379(50)	3.9 ijk	82.2 ef	29.6	8.8
Raider 202(75)/DP 2379(25)	4.4 b-g	83.3 bcd	30.3	8.0
Raider 202	4.3 e-j	84.5 a	31.3	8.0
Raider 202(75)/Explorer(25)	4.1 f-j	83.0 cde	31.0	9.8
Raider 202(50)/Explorer(50)	4.0 g-k	82.0 ef	30.9	8.6
Raider 202(25)/Explorer(75)	4.9 a	82.0 ef	30.3	8.8
Explorer	4.7 abc	84.5 a	30.7	8.6
DP 2379	4.6 a-e	84.1 a	30.5	8.7
Raider 271(25)/DP 2379(75)	4.8 abc	82.0 ef	29.9	9.4
Raider 271(50)/DP 2379(50)	4.4 d-h	80.3 g	30.3	8.3
Raider 271(75)/DP 2379(25)	3.6 k	82.9 c-f	31.3	8.6
Raider 271	4.4 b-g	84.3 a	31.6	9.1
Raider 271(75)/ Explorer(25)	3.9 ijk	82.8 def	30.6	8.5
Raider 271(50)/ Explorer(50)	3.7 jk	80.9 g	30.7	8.8
Raider 271(25)/ Explorer(75)	4.2 e-i	82.2 ef	29.8	9.5
LSD ($P \leq 0.05$)	0.47	1.0	NS	NS
CV (%)	13.5	1.5	5.9	15.1

[z] Means within a column followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's Pooled Least Significant Difference Test.

cultivars. Cotton blends by location interactions were significant for fiber length, lint yield, and gross return for the three irrigated environments (Table 2), so the data for these environments is reported separately (Table 4). In general, the yields of the blended cultivars were intermediate to the yields of the component cultivars or similar to the highest yielding component cultivar. Likewise, the fiber length values for most blends are either intermediate to the values of the component cultivars or as high and not statistically different from the highest length values of the component cultivar. Gross return is a reflection of lint yield and quality parameters. The blend Raider 202(75)/Explorer (25) had higher gross return than the mean of its components across all the three irrigated environments.

For the two dry land environments (2001), none of the cultivar/blend by environment interactions were statistically significant; therefore, data for the cultivars and blends are reported as means across locations and replications (Table 5). Unlike the irrigated environments, the data for the dry land locations indicated significant micronaire differences with micronaire values for the blends being higher than for monocultures. Significant differences in fiber length were detected with lengths for the blends falling being intermediate to the lengths of the monocultures, indicating that the blends improved fiber length compared with the low length blend component. Similar to the irrigated environments, blending had no effect on fiber strength and elongation. Fiber uniformity for dry land environments was significantly higher in the monoculture cultivars compared with their blends. The lint yields of the blends were intermediate to the monoculture components and significant differences detected. Significant differences for gross return were also observed with two blends, Raider 202(75)/ Explorer(25) and Raider 271(75)/ Explorer(25), which had higher gross return values than the means of their individual components.

Table 4. Summary of lint yield, fiber length, and gross return data for cultivars and cultivar blends grown at Lubbock and New Deal, TX, under irrigated conditions

Cultivar/blend	2001 Lubbock irrigated			2002 Lubbock irrigated			2001 New Deal irrigated		
	Lint yield (kg/ha)	Fiber length (mm)	Gross return ($/ha)	Lint yield (kg/ha)	Fiber length (mm)	Gross return ($/ha)	Lint yield (kg/ha)	Fiber length (mm)	Gross return ($/ha)
DP 2379	1139 a[z]	27 cd[z]	1248 a-d[z]	1300 az	27 d-g[z]	1507 a[z]	984 ab[z]	27 efg[z]	1058 a-f[z]
Raider 202(25)/DP 2379(75)	971 c-f	28 bc	1077 efg	1270 ab	29 a	1391 abc	990 ab	29 bc	1077 a-f
Raider 202(50)/DP 2379(50)	1057 a-d	27 cd	1149 b-f	984 f-I	29 a	1107 f	905 a-e	26 i	996 c-h
Raider 202(75)/DP 2379(25)	1049 a-e	28 bc	1260 ab	1118 c-f	28 bg	1302 bcd	984 ab	29 bc	1166 abc
Raider 202	1021 a-e	29 a	1233 a-f	1010 e-i	29 a[z]	1236 c-f	909 a-d	28 b-e	1082 a-f
Raider 202(75)/Explorer(25)	1055 a-e	27 cd	1208 a-f	1186 a-d	27 d-g	1379 bc	998 a	28 b-e	1181 a
Raider 202(50)/Explorer(50)	983 c-f	28 bc	1090 d-g	1101 d-g	29 a	1253 c-f	858 b-f	29 bc	959 e-h
Raider 202(25)/Explorer(75)	1049 a-e	27 cd	1139 b-f	1129 b-e	27 d-g	1223 c-f	772 f	27 efg	850 g-h
Explorer	938 def	27 cd	1028 g	995 e-i	27 d-g	1154 def	851 c-f	27 efg	937 e-h
DP 2379	1139 a	27 cd	1248 a-d	1300 a	27 d-g	1507 a	984 ab	27 efg	1058 a-f
Raider 271(25)/DP 2379(75)	1040 a-e	26 e	1117 b-g	1256 abc	27 d-g	1369 bc	888 a-e	27 efg	979 d-h
Raider 271(50)/DP 2379(50)	1096 abc	29 a	1240 a-e	1146 b-e	27 d-g	1255 c-f	902 a-e	29 bc	1011 b-g
Raider 271(75)/DP2379(25)	925 def	28 bc	1070 fg	969 ghi	28 b-g	1369 bc	786 def	29 bc	917 fgh
Raider 271	1022 a-e	29 a	1240 a-e	982 f-i	29 a	1198 def	929 a-d	30 a	1132 a-d
Raider 271(75)/Explorer(25)	986 b-f	28 bc	1127 b-f	1110 d-g	28 b-g	1300 bcd	859 b-f	27 efg	996 c-h
Raider 271(50)/Explorer(50)	922 f	29 a	1075 fg	1132 b-e	28 b-g	1245 c-f	734 f	27 efg	838 h
Raider 271(25)/Explorer(75)	1015 b-f	26 e	1087 fg	1191 a-d	29 a	1287 cde	897 a-e	26 i	988 d-h
LSD ($P \leq 0.05$)	120	0.06	67	126	0.06	69	134	0.04	70
CV (%)	9.3	3.7	10.1	9.0	4.1	9.5	11.8	2.8	11.9

[z] Means within a column followed by the same letter are not significantly different at the $P \leq 0.05$ according to Fisher's Pooled Least Significant Difference Test.

Table 5. Summary of lint yield, quality, and gross return data across two dryland environments at Lubbock and New Deal in 2001

Cultivar/blend	Micronaire	Fiber length (mm)	Uniformity (%)	Fiber strength (cN/tex)	Elongation	Lint yield (kg/ha)	Gross return ($/ha)
DP 2379	4.6 a-e	26 hi	83.4 de	30.9	9.9	683 a	697 bc
Raider 202(25)/DP 2379(75)	5.1 ab	27 gh	81.9 f-j	30.9	8.9	660 abc	682 bcd
Raider 202(50)/DP 2379(50)	4.9 a-d	29 a	81.0 h-k	30.5	8.5	610 a-e	657 bcd
Raider 202(75)/DP 2379(25)	4.6 a-e	28 d-g	82.2 eh	30.2	8.5	623 a-d	756 a
Raider 202	4.2 def[z]	29 a[z]	84.9 ab[z]	31.0	7.6	358 i[z]	685 a-i[z]
Raider 202(75)/Explorer(25)	4.2 def	28 d-g	81.3 h-k	29.9	7.7	622 a-d	734 ab
Raider 202(50)/Explorer(50)	5.2 a	28 d-g	81.4 g-j	30.7	8.0	529 d-i	573 d-h
Raider 202(25)/Explorer(75)	4.8 a-e	28 d-g	82.2 e-h	31.9	8.7	494 ghi	534 f-i
Explorer	4.0 f	27 gh	83.4 de	29.5	9.4	493 d-i	492 ghi
DPL 2379	4.6 a-e	26 hi	83.4 de	30.9	9.9	683 a	697 bc
Raider 271(25)/DP 2379(75)	4.7 a-e	26 hi	82.1 f-i	29.3	9.6	595 b-f	628 c-g
Raider 271(50)/DP 2379(50)	4.4 c-f	28 d-g	80.2 k	29.5	8.6	605 a-e	652 bcd
Raider 271(75)/DP 2379(25)	4.9 a-d	29 a	80.9 ijk	29.9	7.4	478 ghi	541 e-i
Raider 271	4.2 def	29 a	85.0 a	31.7	7.7	544 d-h	667 b-f
Raider 271(75)/Explorer(25)	4.4 c-f	28 d-g	82.2 e-h	30.6	8.9	543 d-h	650 b-e
Raider 271(50)/Explorer(50)	5.0 abc	28 d-g	80.8 k	30.8	8.8	452 hi	494 hi
Raider 271(25)/Explorer(75)	5.2 a	28 d-g	81.5 g-j	29.6	8.4	502 ghi	524 ghi
LSD ($P \leq 0.05$)	0.7	0.04	1.2	NS	NS	86.0	45.0
CV (%)	15.2	3.6	1.5	6.1	17.4	17.0	18.0

[z] Means within a column followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's Pooled Least Significant Difference Test.

Genotype by environment interaction and stability analysis on lint yield was conducted using the method suggested by Eberhart and Russell (1966). The pooled analysis of variance (Table 6) indicated that there were significant differences between the five environments and the blend by environment interactions; however, no significant effects were observed between the 16 cultivars and cultivar blends. This method involves the regression of each individual cultivar on an environmental index, calculating a slope (b) and a deviation from regression ($s^2{}_d$) statistic. According to Eberhart and Russell (1966), a cultivar can be considered stable if its slope is equal to 1, and its deviation from regression approaches zero. Of the four cultivars included in the blend, Explorer is the cultivar that best meets this definition; however, if yield is factored into the definition then DP 2379 would be the most desirable genotype. Three blends, Raider 202(75)/Explorer (25), Raider 202(75)/DP 2379(25), and Raider 271(50)/DP 2379(50), combined above average mean yield and desirable stability across the five test environments (Table 7). The most unfavorable environments have negative environmental index values (Lubbock and New Deal Dry) and the favorable environments have positive values (the three irrigated environments at Lubbock and New Deal) (Fig. 1 and Fig. 2). The Raider 202(75)/Explorer(25) blend had higher yield than both monoculture cultivars under both favor-

Table 6. Pooled analysis of variance for lint yield (kg/ha) for all cultivars and their blends tested across five environments

Source	df	Mean squares	F[z]
Environments	4	196.85	64.75*
Reps(Environments)	15	3.04	
Cultivars/Blends	15	2.50	0.83 ns
Environments*Blends	60	3.03	1.84*
Error	180	1.64	

[z] Values followed by * are significantly different at $P \leq 0.05$.

able and unfavorable environments. The gap in yield between this blend and its monoculture components increases as the environment gets better (Fig. 1; Table 8). In general, as the environment improves, this particular blend does better than its component cultivars. The blends with DP 2379, however, did not show any lint yield advantage of the blends over the component cultivars. DP 2379 yielded higher than any of its blends under both favorable and unfavorable environments (Fig. 2; Table 8). This indicates that not all cultivars perform the same when blended together. Raider 202 blends tend to be more responsive to improvements in the growing environment than Raider 202 alone (slopes rises from 0.88 to closer to unity). A notable problem is that blends with Raider 202 seem to exhibit greater deviations from regression. Blends with Raider 271 help reduce the slope of Raider 271. Blends also reduced the high deviation from regression of monoculture Raider 271 with yields (generally) equal to the arithmetic mean of the two components.

Table 7. Mean lint yield, stability value (b) and deviations (s^2d) for 16 cultivars and their blends grown across five environments

Cultivars/blends	Mean	b	s^2d
Raider 202	811.19	0.8813	615.90
Raider 271	803.80	1.3970	-36538.59
DPL 2379	957.62	1.0669	-892.66
Explorer	755.93	0.9698	-258.51
Raider 202 (75) + Explorer (25)	896.43	0.9736	-323.67
Raider 202 (50) + Explorer (50)	799.72	1.0030	-1774.95
Raider 202 (25) + Explorer (75)	786.98	1.1132	14185.04
Raider 202 (25) + DPL 2379 (75)	908.71	0.9855	-27294.08
Raider 202 (50) + DPL 2379 (50)	832.81	0.8155	2720.02
Raider 202 (75) + DPL 2379 (25)	879.34	0.9506	-199.91
Raider 271 (25) + Explorer (75)	821.38	1.1924	-1455.85
Raider 271 (50) + Explorer (50)	738.50	1.1038	2639.81
Raider 271 (75) + Explorer (25)	808.21	1.0096	-1829.20
Raider 271 (25) +DPL 2379 (75)	874.80	1.0719	1699.33
Raider 271 (50) + DPL 2379 (50)	871.11	0.9743	-583.89
Raider 271 (75) + DPL 2379 (25)	726.96	0.9382	-1297.97
Mean	829.59	0.8414	

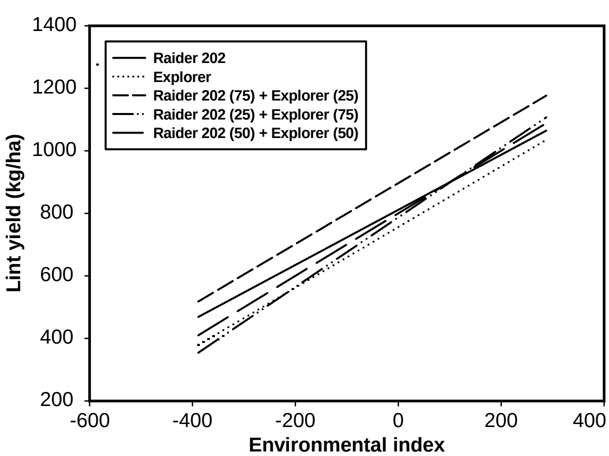

Figure 1. Linear regression of lint yield by the environmental index for Raider 202, Explorer, and their three blends.

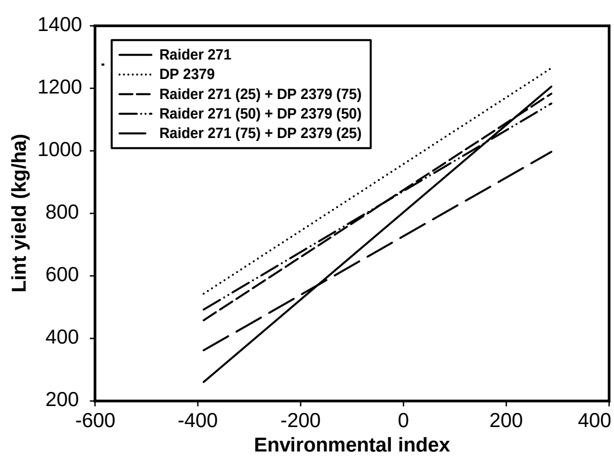

Figure 2. Linear regression of lint yield by the environmental index for Raider 271, DP 2379, and their three blends.

Table 8. Regression equations for lines depicted in Figures 1 and 2.

Cultivar/blend	Equation	$R^{2\,z}$
Raider 202	y = 0.8813x + 811.2	0.90
Explorer	y = 0.9698x + 755.9	0.91
Raider 202 (75) + Explorer (25)	y = 0.9736x + 896.4	0.96
Raider 202 (50) + Explorer (50)	y = 1.0025x + 799.9	0.93
Raider 202 (25) + Explorer (75)	y = 1.1132x + 787.0	0.93
Raider 271	y = 1.3970x + 803.8	0.90
DP 2379	y = 1.0669x + 957.6	0.95
Raider 271 (75) + DP 2379 (25)	y = 0.9382x + 727.0	0.91
Raider 271 (50) + DP 2379 (50)	y = 0.9743x + 871.1	0.92
Raider 271 (25) + DP 2379 (75)	y = 1.0719x + 874.8	0.96

[z] All values are significant at P = 0.01 (n = 20).

CONCLUSIONS

The lint yields of the blended cultivars were often between the lint yields of the components. Relative to the low yielding component, the yields of the blends were higher. Blending across all environments had no effect on fiber strength and elongation. Simpson and Fiori (1974) also reported that blending has no effect on fiber strength. Micronaire readings for the blends were lower in the irrigated environment but higher in dry land environments compared with the monocultures. Uniformity values were generally reduced by blending. In general, the blends improved fiber length and lint yield compared with the lowest yielding component of the blend. But this did not significantly increase economic return as estimated by the gross return values of the blends and cultivars. Blending of cultivars might serve as a short term alternative, but it can not substitute for the breeding of cotton cultivars with both high yield and high fiber quality. Faircloth et al. (2003) arrived at a similar conclusion. The genotype by environment interaction and stability analyses of the data, however, indicate that some blends have better adaptation and stability across environments compared with their individual components. In general, the blends produce greater lint yield than their individual components in favorable environments. Some cultivars also do better in blends than other cultivars.

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REFERENCES

Agi, A.L., J.S. Mahaffey, J.R. Bradley, Jr. and J.W. Van Dwyn. 2001. Efficacy of seed mixtures of transgenic Bt and nontransgenic cotton against bollworms, *Helicoverpa zea* Boddie [Online]. J. Cotton Sci. 5 (2): 74-80. Available at http://www.cotton.org/journal/2001-05/2/74.cfm

Bridge, R.R., S.R. Miller, and S.M. Lane. 1984. The influence of binary seed mixtures of 'Stoneville 825' and 'Deltapine 41' cotton cultivars on their performance. Bulletin # 931. Miss. Agric. For. Exp Stn., Mississippi State, MS.

Cotton Incorporated. 2006. U.S. cotton fiber chart for 2006. Cotton Incorporated, Cary, NC. Available online at www.cottoninc.com/fiberquality

Craig, C., and O. Gwathmey. 2003. Variety blends for improved fiber quality in Tennessee. p. 2556. *In* Proc. Beltwide Cotton Conf., Nashville, TN, 6-10 Jan., 2003. Natl. Cotton Counc. Am., Memphis, TN.

Dobbs, R.R., N. Buehring, S.P. Nichols, and M.P. Harrisson. 2007. Improving fiber quality by planting and harvesting two varieties together. p. 486. *In* Proc. Beltiwde Cotton Conf., New Orleans, LA, 9-12 Jan., 2007. Natl. Cotton Counc. Am., Nashville, TN.

Durant, J.A. 1995. Efficacy of selected seed mixes of transgenic Bt and nontransgenic cotton against bollworms and tobacco budworms in South Carolina. p. 769-771. *In* Proc. Beltwide Cotton Conf., San Antonio, TX, 4-7 Jan. 1995. Natl. Cotton Counc. Am., Memphis, TN.

Eberhart, S.A., and W.A. Russell. 1966. Stability parameters for comparing varieties. Crop Sci. 6:26-40.

Faircloth, J.C., K. Edmiston, R. Wells, and A. Stewart. 2003. Planting cotton cultivar mixtures to enhance fiber quality [Online]. J. Cotton Sci. 7: 51-56. Available at http://www.cotton.org/journal/2003-07/3/51.cfm

Hequet, E.F., and D. Ethridge. 2005. Impacts of fiber length distribution on market value and yarn quality: implications for U.S. cotton. Engineered Fiber Selection (EFS) System Conf., 18th, Memphis, TN. 6-8 June 2005. Cotton Incorporated, Cary, NC.

Innes, N.L. 1977. Performance of seed mixtures and multilines of upland cotton in Uganda. J. Agric. Sci. (Cambridge) 88: 47-54.

McConnel, J.S., F.M. Bourland, B.S. Frizzel and W.H. Baker. 1991. Enhanced cotton strength through the use of blended cultivars. Arkansas Farm Res. 40 (5): 3.

Poehlman, J.M., and D.A. Sleper.1995. Breeding field crops. Iowa State University Press, Ames, Iowa.

Simpson, J and L.A. Fiori. 1974. Effects of mixing cottons differing in micronaire reading and carding variables on cotton variety quality, yarn properties, and end breakage. Textile Res. J. 44 (5): 327-333.