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EFFECT OF VARIETAL BLENDS ON FIBER QUALITY AND LINT YIELD ON UPLAND COTTON IN WEST TEXAS

Aaron S Alexander, Efrem Bechere and Dick L. Auld
Texas Tech University
Lubbock, TX

Abstract

During the years 2001 and 2002 an attempt was made at Texas Tech University to study the effects of varietal blending on fiber quality and lint yield. Four commercial varieties were used , Raider 271 and Raider 202 for their staple lengths and Delta and Pineland's 2379 and Explorer for their high yielding properties. The varieties were combined in three different blends, 25:75, 50:50, and 100:0. The experiments were carried out at two different locations, Lubbock, TX and New Deal, TX. Each location had a dry land plot and a drip irrigated plot. Each plot was replicated four times. Some of the blends combined the good yield and good fiber lengths of the parent lines, but overall the blends have shown more noticeable increases in yield than in fiber length.

Introduction

It is assumed that varietal mixtures should be more productive than corresponding pure stands, but experimental evidence to prove this has been scanty. Delta and Pineland 2379 and Explorer are two varieties that have higher yields in the Texas High Plains but show lower staple lengths. Raider 202 and Raider 271, two varieties developed by Texas Tech University, have longer staple lengths but have considerably lower yields than DP 2379 and Explorer. So this study was conducted to determine if blending DP 2379 and Explorer with Raider 202 and Raider 271 will offer yields comparable to DP 2379 and Explorer while increasing the staple length.

Objective

The objective was to find out if blending different cotton varieties will have an impact on lint yield and fiber quality of cotton in West Texas.

Materials and methods

This study was conducted over a period of 2 years, 2001 and 2002. Four separate commercial varieties were used, namely, Raider 202, Raider 271, D&PL 2379, and Explorer. Raider 202 and Raider 271 were used for their fiber quality properties and D&PL 2379 and Explorer were used for their lint yielding properties. Three different blending ratios were used, 25:75, 50:50, and 100:0, and each blend was thoroughly mixed before planting. The experiment was conducted at two different locations, Lubbock, TX and New Deal, TX. Each location had two different experiments planted under the two different irrigation schemes adding up to four experiments per location. Each experiment was planted with four replications on forty inch row spacing with the rows being thirty feet in length. Planting was done at the end of May of each year. The nurseries were weeded and fertilized when needed and in 2001 the nurseries were sprayed with Malathion by the Texas Bowl Weevil Eradication Service. The experiments were also planted with 3 pounds of Temic insecticide per acre and Triflurain preemergant herbicide at twenty four fluid ounces per acre. The plant population at planting was five seeds per foot and with the blends this corresponded to seed ratios of 38:112 (25:75), 75:75 (50:50), and 150:0 (100:0). Data was analyzed using the SAS computer program.

Results and Discussion

At the end of each harvest we took the whole plot weights to calculate lint yield and we also took a smaller grab sample that was ginned and taken to Texas Tech's International Textile Center for HVI analysis.

Once we received the data back from ITC we ran the HVI results through SAS to start the results portion of the study. All tables were set up by the variable that they contained, such as length, strength, and yield. In this study we examined two of the three major variety components, length and strength. Micronaire was not compared throughout

the study because it had significant correlations that made it hard to work with and we believe this happened because of the variability of micronaire throughout the plant and the lower night temperatures seen in 2002.

Length

Length was the major quality component that showed significant variation throughout the study. Length was a function of the blends and usually showed a median between the two parental varieties.

Table 1. Summary of HVI fiber length for cotton blend varieties across 4 irrigated environments.

	2001			2002		
Blend/Variety	**Lbb Irr**	**ND Irr**	**Mean**	**Lbb Irr**	**ND Irr**	**Mean**
	----------Inches----------					
271 (100)	1.15 ab[+]	1.15 a[+]	1.15	1.13 cd[+]	1.19 a[+]	1.16
DP2379 (100)	1.08 cde	1.08 de	1.08	1.15 bcd	1.11 f	1.13
271 (75) + 2379 (25)	1.12 a-d	1.13 ab	1.13	1.16 bcd	1.17 abc	1.17
271 (50) + 2379 (50)	1.17 a	1.14 a	1.16	1.12 cd	1.13 def	1.13
271 (25) + 2379 (75)	1.03 e	1.08 de	1.06	1.13 cd	1.13 def	1.13
271 (100)	1.15 ab	1.15 a	1.15	1.13 cd	1.19 a	1.16
Explorer (100)	1.09 cde	1.09 bcd	1.09	1.18 abc	1.13 def	1.16
271(75) +Exp(25)	1.11 a-d	1.08 cd	1.10	1.16 bcd	1.11 f	1.14
271(50) +Exp(50)	1.17 a	1.06 def	1.12	1.14 bcd	1.14 c-f	1.14
271(25) +Exp(75)	1.04 e	1.03 ef	1.04	1.20 ab	1.12 f	1.16
202 (100)	1.14 abc	1.12 abc	1.13	1.22 a	1.18 ab	1.20
DP2379 (100)	1.08 cde	1.08 de	1.08	1.15 bcd	1.11 f	1.13
202(75) +2379(25)	1.11 a-d	1.13 ab	1.12	1.14 bcd	1.16 b-e	1.15
202(50) +2379(50)	1.08 cde	1.03 f	1.06	1.12 cd	1.16 b-e	1.14
202(25) +2379(75)	1.11 a-d	1.13 ab	1.12	1.14 bcd	1.14 c-f	1.14
202 (100)	1.14 abc	1.12 abc	1.13	1.22 a	1.18 ab	1.20
Explorer (100)	1.09 cde	1.09 bcd	1.09	1.18 abc	1.13 def	1.16
202(75) +Exp(25)	1.09 cde	1.12 abc	1.11	1.12 cd	1.16 b-e	1.14
202(50) +Exp(50)	1.10 bcd	1.13 ab	1.12	1.16 bcd	1.17 abc	1.17
202(25) +Exp(75)	1.07 de	1.07 def	1.07	1.17 a-d	1.14 c-f	1.16
CV (%)	3.7	2.8	3.3	3.4	2.2	2.8
LSD (0.05)	0.06	0.04	0.05	0.06	0.04	0.05

[+] Means within columns not followed by the same letter differ at the 0.05 level of probability by Fisher's Protected Least Significance Difference.

Table 2. Summary of HVI fiber length for cotton blend varieties across 4 dry land environments.

	2001			2002		
Blend	**Lbb Dry**	**ND Dry**	**Mean**	**Lbb Dry**	**ND Dry**	**Mean**
	----------Inches----------					
271 (100)	1.17 a[+]	1.18 ab[+]	1.18	1.10 ab[+]	1.12 a[+]	1.11
DP2379 (100)	1.03 g	1.04 f	1.04	1.14 a	1.03 def	1.09
271(75) +2379(25)	1.12 a-d	1.17 ab	1.15	1.14 a	1.03 def	1.09
271(50) +2379(50)	1.08 a-g	1.12 a-e	1.10	1.08 ab	1.05 cde	1.07
271(25) +2379(75)	1.06 fg	1.05 ef	1.06	1.06 b	1.03 def	1.05

271 (100)	1.17 a[+]	1.18 ab[+]	1.16	1.10 ab[+]	1.12 a[+]	1.11
Explorer (100)	1.06 efg	1.07 def	1.07	1.12 a	1.04 cde	1.08
271(75) +Exp(25)	1.10 b-f	1.17 ab	1.14	1.09 ab	1.03 def	1.06
271(50) +Exp(50)	1.10 b-f	1.13 a-e	1.12	1.13 a	1.08 bc	1.11
271(25) +Exp(75)	1.11 b-e	1.10 c-f	1.11	1.11 ab	1.00 f	1.06
202 (100)	1.15 a	1.19 a	1.17	1.10 ab	1.09 ab	1.10
DP2379 (100)	1.03 g	1.04 f	1.04	1.14 a	1.03 def	1.09
202(75) +2379(25)	1.11 b-e	1.13 a-d	1.12	1.10 ab	1.05 cde	1.08
202(50) +2379(50)	1.12 a-d	1.16 abc	1.14	1.11 ab	1.07 b-e	1.09
202(25) +2379(75)	1.07 d-g	1.10 c-f	1.09	1.10 ab	1.07 b-e	1.09
202 (100)	1.15 a	1.19 a	1.17	1.10 ab	1.09 ab	1.10
Explorer (100)	1.06 efg	1.07 def	1.07	1.12 a	1.04 cde	1.08
202(75) +Exp(25)	1.13 abc	1.13 a-d	1.13	1.12 a	1.08 bc	1.10
202(50) +Exp(50)	1.12 a-d	1.12 a-e	1.12	1.09 ab	1.09 ab	1.09
202(25) +Exp(75)	1.06 efg	1.11 b-e	1.09	1.13 a	1.08 bc	1.11
CV (%)	3.4	4.5	3.6	3.8	2.6	3.0
LSD (0.05)	0.05	0.07	0.06	0.06	0.04	0.05

[+] Means within columns not followed by the same letter differ at the 0.05 level of probability by Fisher's Protected Least Significance Difference

Fiber length values varied from one year to another (Tables 1 and 2).Some blends, such as (e.g. 271 (50) + 2379(50)), show better fiber length in 2001 (Lubbock Irrigated and New Deal Irrigated) (Table 1) than in 2002. Overall fiber length values were intermediate between the component and blend fiber length values (Tables 1 and 2).

Strength

Strength was not a very strong variable to study. It showed very little significant differences throughout both years or throughout the environments. The irrigated study showed very little significant difference while the dry land showed just a bit more.

Table 3. Summary of HVI fiber strength for cotton blend varieties across 4 irrigated environments.

	2001			2002		
Blend/Variety	**Lbb Irr**	**ND Irr**	**Mean**	**Lbb Irr**	**ND Irr**	**Mean**
	----------**g/tex**----------					
271 (100)	32.4 a[+]	31.4 a[+]	31.9	32.2 b[+]	30.8 ab[+]	31.5
DP2379 (100)	31.7 ab	30.2 a	31.9	32.4 ab	30.2 b	31.3
271 (75) + 2379 (25)	31.3 abc	32.0 a	31.7	32.8 ab	30.7 ab	31.8
271 (50) + 2379 (50)	31.4 abc	30.9 a	31.2	32.5 ab	30.2 b	31.4
271 (25) + 2379 (75)	29.1 c	32.0 a	30.6	32.8 ab	30.4 b	31.6
271 (100)	32.4 a	31.4 a	31.9	32.2 b	30.8 ab	31.5
Explorer (100)	31.9 a	31.2 a	31.6	32.0 b	31.5 ab	31.8
271 (75) + Exp (25)	31.2 abc	31.0 a	31.1	32.8 ab	30.3 b	31.6
271 (50) + Exp (50)	32.4 a	31.9 a	32.2	33.0 ab	30.5 b	31.8
271 (25) + Exp (75)	30.5 abc	30.4 a	30.5	33.8 a	30.5 b	32.2

202 (100)	32.1 a	31.0 a	31.6	32.6 ab	32.3 a	32.5
DP2379 (100)	31.7 ab	30.2 a	31.0	32.4 ab	30.2 b	31.3
202 (75) + 2379 (25)	31.1 abc	31.3 a	31.2	33.4 ab	30.8 ab	32.1
202 (50) + 2379 (50)	29.1 c	29.9 a	29.5	32.9 ab	31.0 ab	32.0
202 (25) + 2379 (75)	32.6 a	31.0 a	31.8	32.7 ab	30.1 b	31.4
202 (100)	32.1 a	31.0 a	31.6	32.6 ab	32.3 a	32.5
Explorer (100)	31.9 a	31.2 a	31.6	32.0 b	31.5 ab	31.7
202 (75) + Exp (25)	30.9 abc	31.7 a	31.3	33.4 ab	30.8 ab	32.1
202 (50) + Exp (50)	29.5 bc	32.1 a	30.8	33.0 ab	30.5 b	31.8
202 (25) + Exp (75)	31.3 abc	31.7 a	31.5	33.5 ab	30.7 ab	32.1
CV (%)	5.4	5.6	5.5	3.2	3.7	3.4
LSD (0.05)	2.40	1.51	1.96	1.51	1.60	1.56

[+]Means within columns not followed by the same letter differ at the 0.05 level of probability by Fisher's Protected Least Significance Difference.

Table 4. Summary of HVI fiber strength for cotton blend varieties across 4 dry land environments.

	2001			2002		
Blend	**Lbb Dry**	**ND Dry**	**Mean**	**Lbb Dry**	**ND Dry**	**Mean**
	----------g/tex----------					
271 (100)	33.1 a[+]	33.0 ab[+]	33.1	33.4 a[+]	30.4 b[+]	31.9
DP2379 (100)	32.6 ab	31.9 a-d	32.3	34.4 a	27.9 f	32.2
271 (75) + 2379 (25)	29.8 c	31.2 a-d	30.5	34.3 a	29.6 bc	32.0
271 (50) + 2379 (50)	29.9 bc	30.4 a-d	30.2	34.4 a	29.0 cde	31.7
271 (25) + 2379 (75)	29.8 c	29.9 cd	29.9	33.2 a	29.6 bc	31.4
271 (100)	33.1 a	33.0 ab	33.1	33.4 a	30.4 b	31.9
Explorer (100)	31.6 abc	29.4 d	30.5	34.0 a	28.2 ef	31.1
271 (75) + Exp (25)	30.7 abc	31.7 a-d	31.2	33.7 a	29.3 cd	31.5
271 (50) + Exp (50)	32.2 abc	30.7 a-d	31.5	32.0 a	29.1 cde	30.6
271 (25) + Exp (75)	30.0 bc	30.3 bcd	30.2	33.7 a	29.1 cde	31.4
202 (100)	31.3 abc	33.1 a	32.2	33.3 a	31.4 a	32.4
DP2379 (100)	32.6 ab	31.9 a-d	32.3	34.4 a	27.9 f	31.2
202 (75) + 2379 (25)	31.5 abc	30.0 cd	30.8	33.0 a	29.7 bc	31.4
202 (50) + 2379 (50)	31.4 abc	30.8 a-d	31.1	32.9 a	28.3 def	30.6
202 (25) + 2379 (75)	30.7 abc	32.4 abc	31.6	33.5 a	29.2 cde	31.4
202 (100)	31.3 abc	33.1 a	32.2	33.3 a	31.4 a	32.4
Explorer (100)	31.6 abc	29.4 d	30.5	34.0 a	28.2 ef	31.1
202 (75) + Exp (25)	30.0 bc	31.0 a-d	30.5	32.8 a	29.7 bc	31.3
202 (50) + Exp (50)	31.2 abc	31.5 a-d	31.4	33.1 a	30.5 ab	31.8
202 (25) + Exp (75)	32.8 a	32.3 abc	32.6	33.4 a	29.7 bc	31.6
CV (%)	3.2	6.3	4.7	5.9	2.5	4.2
LSD (0.05)	2.72	2.79	2.76	2.83	1.04	1.94

[+] Means within columns not followed by the same letter differ at the 0.05 level of probability by Fisher's Protected Least Significance Difference.

No clear significant difference in fiber strength between the component varieties and blends under dry land and irrigated conditions. Both the components and blends had acceptable levels of fiber strength (about 30 g/tex) (Tables 3 and 4). As you can see in the 2001 New Deal irrigated nursery there was no variation at all (Table 3).

Yield

Yields were taken from each plot and each nursery. In 2002, the New Deal irrigated yield data was lost while in 2002 we did not have the dry land location yields. Both dry land locations in 2002 were pretty torn up after a sand storm and the nurseries being dry land it was very hard for them to recover.

Table 5. Summary of lint yield for cotton blend varieties across 3 irrigated environments.

	2001			2002
Blend	**Lbb Irr**	**ND Irr**	**Mean**	**Lbb Irr**
	----------(lbs/acre)----------			
271 (100)	912 a-e[+]	824 ab[+]	868	810 i[+]
DP2379 (100)	1016 a	878 a	947	1154 a
271 (75) +2379 (25)	825 def	701 bcd	763	864 ghi
271 (50) +2379 (50)	978 abc	806 abc	892	1022 a-e
271 (25) +2379 (75)	927 a-e	792 abc	860	1120 abc
271 (100)	912 a-e	824 ab	868	810 i
Explorer (100)	886 b-f	769 a-d	828	907 e-i
271 (75) +Exp (25)	880 b-f	766 a-d	823	990 c-h
271 (50) +Exp (50)	822 ef	655 d	739	1010 b-f
271 (25) +Exp (75)	905 b-f	800 abc	853	1062 a-d
202 (100)	997 ab	810 abc	904	858 hi
DP2379 (100)	1016 a	878 a	947	1154 a
202 (75) +Exp (25)	941 a-e	890 a	916	1058 a-d
202 (50) +Exp (50)	877 c-f	765 a-d	821	982 d-h
202 (25) +Exp (75)	933 a-e	689 cd	811	1007 c-f
202 (100)	997 ab	810 abc	904	858 hi
Explorer (100)	886 b-f	769 a-d	828	907 e-i
202 (75) +2379 (25)	936 a-e	877 a	907	997 c-g
202 (50) +2379 (50)	943 a-d	807 abc	875	878 f-i
202 (25) +2379 (75)	866 c-f	883 a	875	1133 ab
CV (%)	9.3	11.5	10.4	9.5
LSD (0.05)	120.20	130.30	125.25	133.90

[+] Means within columns not followed by the same letter differ at the 0.05 level of probability by Fisher's Protected Least Significance Difference

Table 6. Summary of lint yield for cotton blend varieties across 2 dry land environments.

	2001		
Blend/Variety	**Lbb Dry**	**ND Dry**	**Mean**
	(lbs/acre)		
271 (100)	667 abc[+]	340 ef[+]	504
DP2379 (100)	716 a	496 ab	606
271 (75) +2379 (25)	546 b-e	307 f	427
271 (50) +2379 (50)	620 a-d	461 abc	541
271 (25) +2379 (75)	621 a-d	441 a-d	531
271 (100)	667 abc	340 ef	504
Explorer (100)	532 cde	339 ef	436
271 (75) +Exp (25)	601 a-e	368 c-f	485
271 (50) +Exp (50)	493 de	315 f	404
271 (25) +Exp (75)	569 b-e	327 f	448
202 (100)	474 e	520 a	497
DP2379 (100)	716 a	496 ab	606
202 (75) +2379 (25)	687 ab	425 b-e	556
202 (50) +2379 (50)	657 abc	459 abc	558
202 (25) +2379 (75)	714 a	459 abc	587
202 (100)	474 e	520 a	497
Explorer (100)	532 cde	339 ef	436
202 (75) +Exp (25)	630 a-d	480 ab	555
202 (50) +Exp (50)	564 b-e	379 c-f	472
202 (25) +Exp (75)	531 cde	350 def	441
CV (%)	16.8	16.6	16.7
LSD (0.05)	143.70	95.00	119.35

[+] Means within columns not followed by the same letter differ at the 0.05 level of probability by Fisher's Protected Least Significance Difference

In 2002 (Lubbock Irrigated) all three blends of raider 271 and DP 2379 yielded significantly higher than the component varieties under irrigated conditions. The blends of raider 271 and Explorer and Raider 202 and Explorer also yielded higher under irrigated conditions. (Table 5). Under dry land conditions the blends yielded intermediately between both component varieties (Table 6).

Conclusion

The cotton blends in the experiment have accomplished their intended objective. The blends have significantly raised the lint yield and staple length of the lowest component varieties (Figures 1 and 2). Further research across more environments is suggested to arrive at a more conclusive and valid result. It would be safe to say that varietal blends are not perfect in that they improve every aspect of the cotton plant and its fiber but the blends do show significant improvements over the parent varieties by themselves.

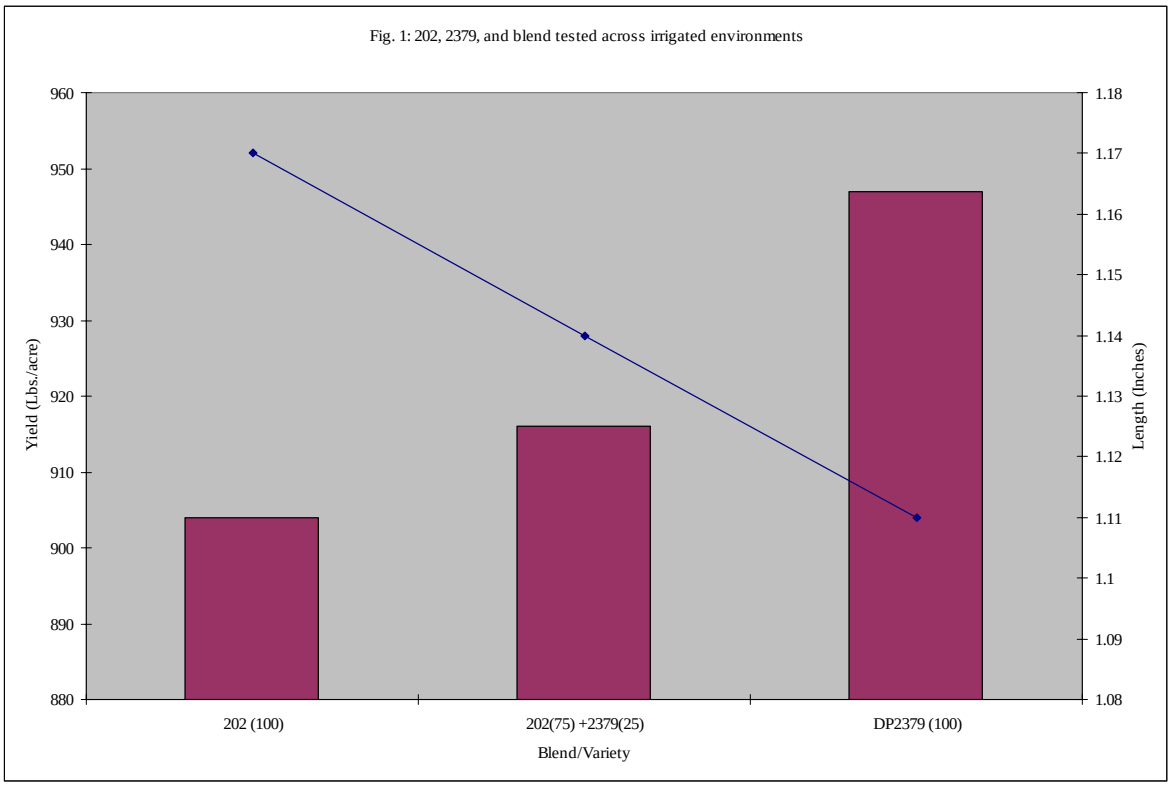

Fig. 1: 202, DP2379, and blend yields and lengths tested across irrigated environments.

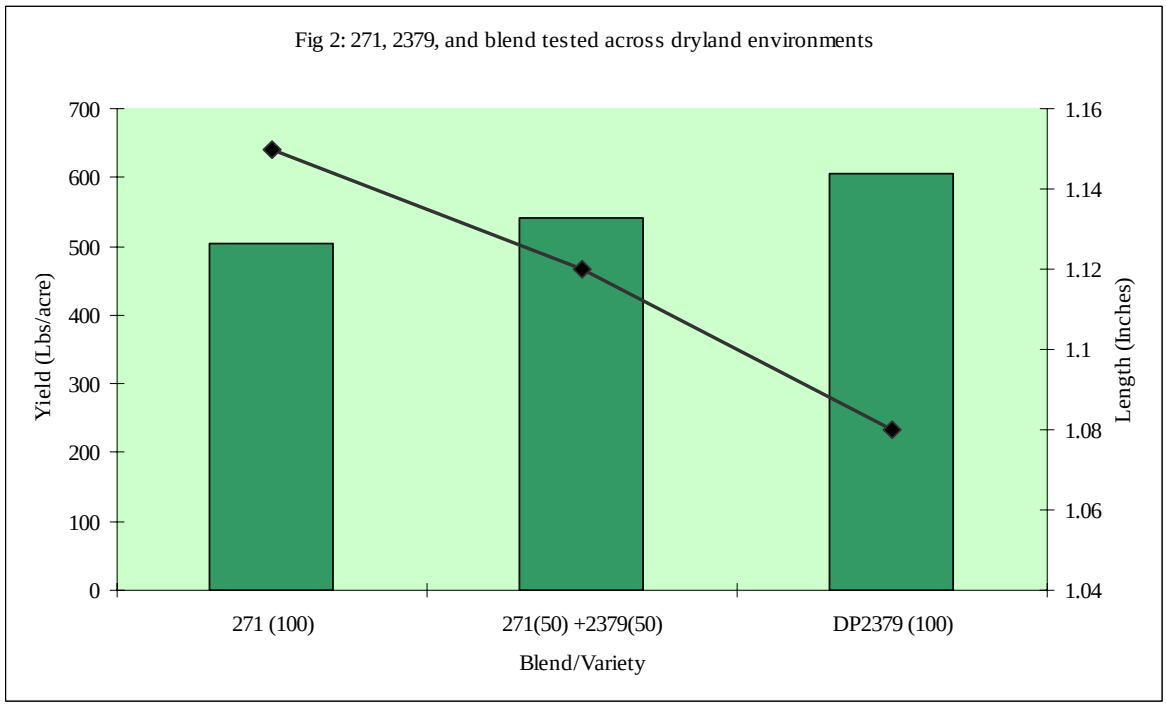

Fig. 1: 271, DP2379, and blend yields and lengths tested across dry land environments.

References

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Acknowledgements

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