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Four cotton varieties of genetically different growth and fruiting habits were grown on two widely different soils under three extremes of water management. Performances of the contrasting genotypes were evaluated in terms of yields, vegetative growth, and lint quality.

Yields were influenced both by water management and variety, with an intermediate irrigation treatment generally most favorable. Low spring temperature reduced yields, especially on a soil having high water-retention capacity. Excessive irrigation caused rank growth in all varieties, but a significant variety-irrigation interaction was observed. Fiber quality was influenced by water management as well as by cotton variety. Less-frequent irrigation generally reduced fiber length in all varieties but the reduction was less for the two Acala varieties. Reduced frequency of irrigation lowered elongation percentage but increased fiber strength.

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INTRODUCTION

OF THE 28 TO 30 INCHES of water that unstressed cotton requires to meet evapotranspiration demands in the San Joaquin Valley, approximately 90 per cent is supplied by irrigation. The remainder may be stored in soils from winter rainfall. In meeting these water demands, irrigation provides a management tool for controlling vegetative growth rate, potential seed cotton production, and, to some extent, lint quality (Adams *et al.*, 1942; Grimes, Yamada and Dickens, 1969; Grimes, Dickens, and Anderson, 1969).

Hanson *et al.* (1956) studied the influence of several environmental factors on Deltapine cottons and observed that year-to-year differences from variations in climate may be greater than differences between two varieties at the same location and year. Increased drought not only generally reduces yield but also reduces the length of cotton lint. In contrast, Eaton and Ergle (1952) reported a 20 per cent increase in tensile strength under a severe moisture deficit. Lint quality characteristics are generally considered to be determined by variety more than by management considerations (Jackson and Tilt, 1968, MacKenzie and van Schaik, 1963), although the moisture supplied has been demonstrated to influence lint quality more than other management considerations. Fiber length is commonly reported to increase 8 to 10 per cent on going from a low to an optimum moisture regime (Bennett *et al.*, 1967).

The vegetative growth of cotton, as expressed by plant height, shows a near linear relation to an increasing water supply. Seedcotton production is usually strongly curvilinear (Gerard and Cowley, 1963; Grimes, Dickens, and Anderson, 1969). Excessive vegetative growth is often associated with difficulty of defoliation before harvest and an appreciable loss in lint production from boll rot (Jackson and Tilt, 1968). Cowan, *et al.* (1962) observed a higher incidence of boll rot in Acala 4-42 than in Deltapine Smooth Leaf which required less strict attention to irrigation and nitrogen fertilization for maximum lint production. Because internode length may be strongly genetically controlled, varieties probably would respond differentially to high levels of water and nutrient availability.

This study evaluated response of four cotton varieties to three basic moisture regimes in the San Joaquin Valley. Responses were evaluated in terms of cotton lint production, lint quality, and vegetative growth characteristics.

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MATERIALS AND METHODS

Because they represent a broad range in vegetative growth, fruiting, maturity, and lint quality, the cultivars Acala 4-42, Acala SJ-1, Deltapine 16, and Coker 310 cotton (*Gossypium hirsutum* L.) were chosen for the study. This broad range of characteristics allowed better evaluation of possible interrelations with water management. The two Acala cottons have been grown extensively on a commercial basis in the San Joaquin Valley, with Acala SJ-1 replacing Acala 4-42 as the official release in 1967. Each variety has shown a good yield potential in extensive testing in the San Joaquin Valley.

Of the varieties selected, Acala 4-42 is the latest-maturing and most indeterminate. Acala SJ-1 grows taller than Acala 4-42 but its branches are shorter and it has a better yield ability. Deltapine 16 has a much shorter growth habit than either of the Acalas and is more determinate, setting fruit in a shorter time. It has a wide range of adaptation and is a major variety in the Mississippi Delta and much of the irrigated West. Coker 310, a newly released early-maturing variety developed and grown principally in the Southeast, shows good yield ability in other areas also, including the irrigated West. Of the four varieties, it is the shortest, most compact in growth habit, and earliest-maturing.

In previous tests, all four cottons have shown acceptable fiber length and fineness, although Deltapine 16 and Coker 310 have not shown the strength and length uniformity typical of the Acalas.

Three irrigation regimes, qualitatively described as wet (W-1), intermediate (W-2), and dry (W-3), were combined factorially with the varieties to form 12 treatments. These treatments were replicated three times in a randomized complete block design at each of two locations. The tests were conducted on a Hesperia sandy loam at the U. S. Cotton Research Station in Kern County (Shafter) for 2 years (1970-71) and on a Panoche clay loam at the U.C. West Side Field Station in western Fresno County for 3 years (1970–71–72). Table 1 shows the irrigation times and amounts of water added at each irrigation and over the season for all treatments, locations, and years.

Soils were preplant irrigated with enough water to wet through the effective cotton rooting depth (about 6 feet). Plots were furrow irrigated, with water delivery to individual plots through gated pipe. Total water delivered to a plot at each irrigation was determined by rate (time per unit volume) and total irrigation time. Irrigation treatments were quantified by monitoring the soil water suction of all plots in two of the three replicates by means of a series of tensiometers (irrometers) and gypsum plugs each placed at 18- and 36-inch depths. The gypsum plugs were calibrated by the method of Kelley (1944), with the calibrations converted to soil-water suction values from pressure-plate water-release characteristic curves. Combined use of tensiometers and gypsum plugs enabled us to monitor the state of soil water through the entire plant available range, except that the resistance meter used at the West Side Station in 1970–71 has an upper limit of –6.7 bars. However, that limit was reached only by the W-3 treatment at the end of the season in both years. Since the cotton root system is generally not fully extended at the time water is first applied, the soil water state at that time is given separately in table 2. The dry state which was reached by the soils at the time plant activity was stopped by defoliant application before first harvest is also reported for each treatment.

TABLE 1

IRRIGATION, PLANTING, AND HARVEST DATES OF COTTON ON A HESPERIA SANDY LOAM AT THE U. S. COTTON RESEARCH STATION AND A PANOCHE CLAY LOAM AT THE U.C. WEST SIDE FIELD STATION

Soil type, year and irrigation number	Irrigation regime					
	W-1		W-2		W-3	
	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)
	planted: May 4; harvested: Oct. 15, and Nov. 12					
Hesperia sandy loam						
1970: 1	6/2	3.25	6/10	3.5	6/22	3.5
2	6/23	3.25	7/6	3.5	7/20	3.5
3	7/10	3.5	7/21	3.5	8/7	4.5
4	7/21	3.5	8/4	4.0		——
5	7/31	3.5	8/21	3.5		11.5
6	8/12	3.5	9/4	3.5		
7	8/24	3.5		——		
8	9/8	3.5		21.5		
9	9/21	2.0				
		——				
	Total =	29.5*				
	planted: April 1; harvested: Oct. 14, and Nov. 11					
1971: 1	6/7	3.0	6/14	3.5	6/29	3.5
2	6/29	3.5	7/9	3.5	7/22	4.0
3	7/13	3.0	7/22	4.0	8/10	4.0
4	7/22	3.5	8/4	4.0		——
5	7/30	3.5	8/17	3.5		11.5
6	8/6	3.5	9/2	3.0		
7	8/17	3.0		——		
8	8/25	3.0		21.5		
9	9/2	3.0				
10	9/9	2.0				
		——				
		31.0				
	planted: April 2; harvested: Oct. 15, and Nov. 12					
Panoche clay loam						
1970: 1	6/4	7.7	6/18	7.1	7/8	10.0
2	7/6	6.4	7/27	8.0		
3	7/29	6.2	8/18	6.1		
4	8/13	5.3		——		
5	9/1	5.5		21.2		
		——				
		31.1				
	planted April 1; harvested: Oct. 22, and Nov. 22					
1971: 1	6/9	6.0	6/16	7.0	7/13	5.6
2	7/2	7.0	7/20	7.5		
3	7/20	7.5	8/17	6.0		
4	8/11	8.7		——		
5	8/31	5.8		20.5		
		——				
		35.0				
	planted: April 3; harvested: Oct. 19, and Nov. 1					
1972: 1	6/5	5.8	6/15	7.3	7/6	6.1
2	6/29	7.5	7/20	7.3		
3	7/17	8.1	8/14	6.5		
4	8/1	6.0		——		
5	8/23	6.5		21.1		
		——				
		33.9				

* A preplant irrigation was added in all years at both locations to wet the soil throughout the rooting zone.

TABLE 2

MAXIMUM NEGATIVE SOIL WATER POTENTIAL (ψ) ATTAINED BY THREE IRRIGATION TREATMENTS IN COTTON ON TWO SOILS

Irrigation	Hesperia sandy loam				Panoche clay loam			
	Depth of measurement (inches)							
		18	36	mean		18	36	mean
	soil water suction, bars (ψ)							
1970:								
W-1	6/2*	0.27	0.26	0.26	6/4	0.41	0.29	0.35
	mean†	0.37	0.44	0.40	mean	1.54	0.42	0.98
	10/2‡	0.22	0.40		9/22	0.34	0.36	
W-2	6/10	0.36	0.30	0.33	6/18	0.60	0.40	0.50
	mean	0.78	1.66	1.22	mean	3.23	1.16	2.19
	10/2	2.99	3.56		10/19	4.62	2.48	
W-3	6/22	0.66	0.26	0.46	7/8	5.24	0.60	2.92
	mean	1.38	1.54	1.45				
	10/2	8.90	6.90		10/19	>6.7	>6.7	>6.7
1971:								
W-1	6/7	0.18	0.24	0.21	6/9	0.42	0.32	0.37
	mean	0.29	0.29	0.29	mean	0.68	0.48	0.58
	10/5	0.38	0.43		10/7	4.93	2.67	
W-2	6/14	0.22	0.24	0.23	6/16	0.60	0.60	0.60
	mean	0.46	0.52	0.49	mean	5.02	1.38	3.20
	10/5	0.38	0.43		10/7	>6.7	5.57	
W-3	6/29	0.62	0.26	0.44	7/13	2.84	0.97	1.89
	mean	2.26	1.88	2.07				
	10/5	8.07	6.25		10/7	>6.7	>6.7	
1972:								
W-1					6/5	0.69	0.32	0.50
					mean	0.77	0.52	0.64
					9/8	0.74	0.75	
W-2					6/15	1.12	0.49	0.81
					mean	5.70	3.60	4.65
					10/5	8.34	7.66	
W-3					7/6	7.30	1.44	4.37
					10/5	8.30	8.10	

* Soil-water suction at time of the first irrigation.
† Maximum negative soil water potential as an average of all irrigations for the treatment.
‡ Soil-water status at end of growing season.

Plots were eight 40-inch rows wide, separated by earthen borders to isolate water application. Plot length was 80 feet at Shafter and 300 feet at the West Side Station. For yield determination, the four center rows of each plot were harvested with a 1-row mechanical harvester. To evaluate earliness characteristics, 13-foot strips (0.001 acre) were hand harvested periodically from each plot before the first mechanical harvest.

Gin turnout and lint properties were evaluated from a 6-pound sample collected from the first mechanical harvest. Lint quality was analyzed in the fiber laboratory at the U. S. Cotton Research Station.

The soils of the two study locations differ considerably from one another but are typical of the range in soil conditions encountered in cotton production. The Hesperia soil is derived from granitic alluvial sediments, while the Panoche soil is derived from recentlydeposited alluvium originating in calcareous sandstone and shale. Little profile development is present in either soil. The Hesperia soil can hold about 1 inch of water per foot of soil depth that plants can extract; the Panoche soil holds at least twice as much.

Plots were seeded in early April (replanting was necessary on May 4, 1970, at Shafter) at rates great enough to allow thinning shortly after complete emergence to a uniform 6 to 8 inches between plants in the row (20,000 to 25,000 plants per acre).

Plant water state was measured with a pressure chamber (Scholander, *et al.*, 1964), a procedure well-adapted to field investigations.

RESULTS AND DISCUSSION

Lint yield

Table 3 shows that cotton lint production was influenced not only by the two primary treatments of the study but also by variations in climate from year to year. Table 4 compares monthly average maximum and minimum temperatures for our study with a 48-year average at the U. S. Cotton Research Station at Shafter.

Cooler-than-normal spring temperatures depress early growth and fruit set of cotton, resulting in lower yields. Because of the high specific heat of water, this effect is more pronounced on soils of high water content such as the Panoche clay loam in this study. Further, long-term studies have related reduced yields to excessively high temperatures in the July and early August peak fruit-set period.[2] In 1970, temperatures in April at both test locations were well below the long-term average, retarding emergence and early growth. Average maximum temperature was approximately 5 degrees below average, and the minimum about 7 degrees below average. Temperatures for the remainder of the 1970 season were near normal. Temperatures again were below average in 1971 for April, but, in contrast to 1970, below-normal temperatures extended through May and June. July was near the long-term average, but the adversity of the cool spring was compounded by above-normal August temperatures during the boll-maturation period. These conditions reduced production throughout the entire San Joaquin Valley cotton-producing area. In contrast, 1972 temperatures were at or above normal from January through June, with good early growth and fruit set. The favorable conditions continued, but with slightly lower average temperatures in July and August. Average production for the 1972 test at the U.C. West Side Field Station location was double that of the two preceding years. The variation in climatic years of the test period and the contrasting soils of the two locations caused several treatment-location-year interactions in a combined analysis of variance (appendix table A).

Hesperia soil

Lowest yields (table 3) on the Hesperia soil resulted from the W-3 (dry) treatment, in which average soil-water suctions for the 18- and 36-inch depths were allowed to drop to –1.45 to –2.07 bars before water was applied (table 2). This treatment received 11.5 inches of water in three irrigations in both years. Maximum yield was associated with the W-2 (intermediate) treatment, which received 21.5 inches in six irrigations during the growing season. The W-1 (wet) treatment, involving excessive water, gave reduced yields for all varieties except Deltapine 16 in 1970 and 1971. This treatment was irrigated nine times (29.5 inches) in 1970 and ten

[2] Personal communication with Dr. Angus Hyer, U. S. Cotton Research Station, Shafter.

TABLE 3

LINT PRODUCTION OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS

Soil type and irrigation treatment	Variety and lint yield*				Irrigation average*
	SJ-1	4-42	DPL-16	Coker 310	
	pounds per acre				
Hesperia sandy loam:					
1970:					
W-1 (wet)	839	770	904	837	838a
W-2 (intermediate)	900	824	874	843	860a
W-3 (dry)	674	645	644	705	667 b
Variety average	804a	747a	807a	795a	
1971:					
W-1	815	700	975	854	836ab
W-2	981	879	916	1020	949a
W-3	792	724	885	824	806 b
Variety average	863ab	768b	925a	899a	
Panoche clay loam:					
1970:					
W-1	805	648	766	519	684a
W-2	738	731	795	565	707a
W-3	822	769	866	592	762a
Variety average	788a	715a	809a	559b	
1971:					
W-1	716	481	803	841	710a
W-2	736	618	832	766	738a
W-3	745	621	846	782	748a
Variety average	732b	573c	827a	796a	
1972:					
W-1	1257	1155	1346	1537	1324 b
W-2	1468	1374	1637	1561	1510a
W-3	1254	1242	1532	1363	1348 b
Variety average	1326b	1257b	1505a	1487a	

* Averages for irrigations or varieties not followed by the same letter differ at a 0.05 probability level according to Duncan's multiple-range test. No significant interaction was observed.

times (31.0 inches) in 1971. Average soil-water suctions reached before irrigation in 1970 and 1971 were respectively –.40 bar and –.29 bar. No large varietal yield differences occurred in 1970 at the Hesperia location, but in 1971 both Deltapine 16 and Coker 310 yielded higher than Acala 4-42. Acala SJ-1 yield was intermediate. No real interactions between water management and variety were evident.

Panoche soil

In contrast with those at the Hesperia location, studies on the Panoche soil in 1970 and 1971 showed no significant yield differences for irrigation variables, although the highest average yield was from the W-3 treatment in both years. Only one summer irrigation was made for this treatment. However, with more water being held in the soil at planting than in Hesperia soil, this treatment is intermediate between the Hesperia W-2 and W-3 treatments in terms of total water available for the season. This, coupled with the low yield potential from adverse low spring tem-

TABLE 4

MONTHLY TEMPERATURES (°F) FOR THE LOCATIONS AND YEARS OF THE STUDY COMPARED WITH A 48-YEAR AVERAGE AT THE U. S. COTTON RESEARCH STATION AT SHAFTER

Month	U. S. Cotton Research Station, Shafter						U. C. West Side Field Station					
	48-yr. average mean		1970 mean		1971 mean		1970 mean		1971 mean		1972 mean	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
January	55.5	35.7	64.5	39.1	55.0	33.1	58.6	37.3	56.2	30.8	47.9	33.9
February	62.1	39.1	66.4	38.3	58.8	33.5	61.0	39.6	58.8	35.1	65.9	40.3
March	68.5	42.3	68.8	41.2	69.2	37.6	66.4	40.6	67.7	39.1	75.8	46.2
April	75.7	47.7	71.0	40.5	73.2	42.7	69.4	39.2	71.1	41.8	75.6	47.7
May	84.3	53.0	88.5	51.7	78.9	50.0	85.5	50.4	76.4	49.9	86.6	52.8
June	92.2	59.2	93.4	59.4	91.4	56.2	90.6	58.4	89.5	55.3	93.5	60.6
July	99.2	64.8	99.1	63.2	100.0	62.4	100.2	63.8	99.1	63.0	96.1	63.4
August	96.6	62.6	95.4	59.6	97.7	62.8	97.2	60.0	99.5	66.0	94.1	62.6
September	90.3	57.2	90.9	51.6	89.3	53.3	92.2	54.5	90.0	57.3	85.7	57.4
October	80.0	48.9	80.3	43.5	76.7	43.2	79.4	47.1	77.5	45.1	74.6	52.6
November	67.3	40.0	70.3	38.8	66.0	35.5	66.6	42.0	65.5	37.7	55.3	40.3
December	56.3	36.3	56.6	36.4	53.5	32.9	53.8	39.9	54.3	33.8	48.5	33.7
Average	77.3	48.9	78.8	46.9	75.8	45.3	76.7	47.7	75.5	46.2	75.0	49.3

TABLE 5

VEGETATIVE GROWTH CHARACTERISTICS OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS

Soil type and irrigation treatment	Final plant height (cm) for varieties*:				Irrigation average*
	SJ-1	4-42	DPL-16	Coker 310	
Hesperia sandy loam:					
1970:					
W-1 (wet)	146	138	129	119	133a
W-2 (intermediate)	130	120	125	107	121 b
W-3 (dry)	122	108	106	90	107 c
Variety average	133a	122b	120b	105c	
1971:					
W-1	154	155	126	114	137a
W-2	141	142	121	107	127 b
W-3	126	112	103	84	106 c
Variety average	140a	136a	117b	102c	
Panoche clay loam:					
1970:					
W-1	131	125	117	95	117a
W-2	111	113	105	88	104 b
W-3	113	109	99	81	100 b
Variety average	119a	116a	107b	88c	
1971:					
W-1	166a	174a	141a	130a	153a
W-2	136 b	143 b	114 b	106 b	124 b
W-3	111 c	100 c	87 c	77 c	94 c
Variety average	103a	104a	85b	78c	
1972:					
W-1	186a	178a	157a	145a	167a
W-2	148 b	136 b	109 b	108 b	125 b
W-3	115 c	106 c	100 c	91 c	103 c
Variety average	150a	140b	122c	115d	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

peratures, resulted in no advantage for the W-2 treatment. Severe Verticillium wilt symptoms on plants were evident at the 1970 Panoche location. Coker 310 has comparatively less resistance than the other varieties and suffered an appreciable yield depression. In 1971, production by Deltapine 16 and Coker 310 was better than by either of the Acala cottons. Yield was appreciably higher for Acala SJ-1 than for Acala 4-42, which was severely depressed by excessive (W-1) irrigation. Yields of all varieties were highest under the W-2 moisture regime in the favorable climate of 1972. This treatment was irrigated three times, totaling 21.1 inches of water during the growing season. Average soil water suction reached –4.65 bars before water was added. Both Deltapine 16 and Coker 310 produced more than did the two Acala varieties.

Combined analysis

In a combined analysis of variance for 1970 and 1971 yields (appendix

TABLE 6

CORRELATION COEFFICIENTS (r) FOR FOUR COTTON VARIETIES BETWEEN COTTON LINT YIELD AND MAXIMUM PLANT HEIGHT OF INDIVIDUAL PLOTS OVER THREE WATER MANAGEMENT REGIMES ($n=9$)

Soil type	Cotton variety*			
	Acala SJ-1	Acala 4-42	Deltapine 16	Coker 310
Hesperia sandy loam				
1970	0.410	0.343	0.694*	0.742*
1971	0.167	−0.039	−0.219	0.025
Panoche clay loam				
1970	−0.081	−0.305	−0.533	−0.036
1971	−0.142	−0.559	−0.334	0.543
1972	−0.198	−0.510	−0.793**	0.155

* The symbols * and ** below represent significance levels at 5% and 1%, respectively.

table A) all main effects, including locations and years, were highly significant. Real first-order interactions were shown between both irrigations and varieties and soil-associated location effects, for reasons previously discussed. A first-order year-variety interaction was attributable to the increased yield of Coker 310 and Deltapine 16 in 1971. A second-order year-variety-location interaction was caused by yield depression of Coker 310 on the Panoche soil in 1970 as a result of severe wilt damage.

Vegetative growth

Cotton plant heights are a sensitive indicator of treatments (Gerard and Cowley, 1963), especially with varied water quantities in arid regions. Table 5 summarizes final plant heights for this study, and appendix table B shows the results of a combined analysis. In general, plant height shows a broad region of positive response to increased water when compared with lint production (Grimes, Dickens, and Anderson, 1969). Water quantities which may be excessive enough to reduce lint yields may also increase vegetative growth (plant height) almost directly proportional to the amount of increased water availability; this can intensify problems associated with rank growth, such as lodging, difficulty of defoliation, and boll rot.

All varieties showed increased height as irrigation intensity increased (table 5). In fact, an exponential increase in plant height with increasing water (increased height at an increasing rate) is shown under adverse conditions of weather and Verticillium wilt at the Panoche location in 1970. This is also shown in the highly significant second-order location-year-irrigation interaction.

The tendency for an exponential increase in plant height was greater for Deltapine 16 and Coker 310 varieties than for Acalas in the 1972 test. The associated yield depression for excessive water, however, was most pronounced for Deltapine 16 and Acala 4-42 varieties.

The tendency for some varieties to grow rank and suffer yield losses is best seen in the series of linear correlation coefficients between yield and plant height shown in table 6. Correlations for individual varieties and years were made over the three water-management treatments and replications of the study. In 1970 at Shafter the shorter-growing varieties, Deltapine 16 and Coker 310, had more positive correlations than did either of the Acalas, indicating that both plant height and

TABLE 7

EARLINESS CHARACTERISTICS OF FOUR COTTON VARIETIES GROWN UNDER WIDE DIFFERENCES IN WATER MANAGEMENT IN 1970 (SEED COTTON PRODUCTION IN THE INDICATED TIME PERIOD WAS DETERMINED FROM TAGGED BOLLS)

Irrigation treatment	Cotton variety	Hesperia (Shafter)				Panoche (West Side Field Station)			
		Period							
		1 (before 7/30)	2 (7/30–8/17)	3 (after 8/17)	Total	1 (before 7/22)	2 (7/22–8/11)	3 (after 8/11)	Total
		grams of seed cotton per 0.001 acre and per cent of total in parentheses							
W-1 (wet)	SJ-1	515* (46)	387 (35)	209 (19)	1111	258 (20)	654 (50)	407 (31)	1319
	4-42	300 (34)	467 (52)	128 (14)	895	235 (23)	559 (54)	240 (23)	1034
	DPL 16	498 (50)	365 (37)	131 (13)	994	353 (26)	794 (59)	189 (14)	1335
	Coker 310	424 (54)	254 (32)	107 (14)	785	451 (49)	392 (42)	80 (9)	923
	Average	434 (46)	368 (39)	144 (15)		324 (30)	600 (51)	229 (19)	
W-2 (intermediate)	SJ-1	319 (25)	571 (46)	368 (29)	1258	338 (26)	780 (59)	200 (15)	1318
	4-42	407 (37)	532 (48)	170 (15)	1109	258 (23)	531 (48)	309 (28)	1098
	DPL 16	522 (41)	522 (41)	215 (18)	1259	359 (27)	875 (65)	115 (8)	1349
	Coker 310	680 (58)	321 (27)	178 (15)	1179	374 (35)	581 (55)	102 (10)	1057
	Average	482 (40)	486 (40)	233 (20)		332 (28)	692 (57)	182 (15)	
W-3 (dry)	SJ-1	417 (42)	475 (47)	110 (11)	1002	498 (35)	636 (45)	270 (20)	1404
	4-42	437 (47)	425 (46)	62 (7)	924	283 (25)	590 (53)	241 (22)	1114
	DPL 16	582 (63)	266 (29)	82 (9)	930	510 (41)	563 (46)	160 (13)	1233
	Coker 310	801 (76)	189 (18)	69 (6)	1059	434 (48)	374 (42)	88 (10)	896
	Average	559 (57)	339 (35)	81 (8)		431 (37)	541 (46)	190 (17)	

* Average of three replications.

TABLE 8

PRODUCTION RATE INDEX (PRI) VALUES FOR A VARIED WATER MANAGEMENT OF FOUR COTTON VARIETIES GROWN ON HESPERIA AND PANOCHE SOILS

Soil type and irrigation treatment	Cotton variety*				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	PRI (pounds per acre per day)				
Hesperia sandy loam:					
1971:					
W-1 (wet)	4.04	3.46	4.98	4.54	4.26 b
W-2 (intermediate)	5.02	4.50	4.78	5.48	4.94a
W-3 (dry)	4.26	3.85	4.86	4.65	4.40ab
Variety average	4.44ab	3.94b	4.87a	4.89a	
Panoche clay loam:					
1971:					
W-1	3.69a	2.43 b	4.00 b	4.35a	3.62 b
W-2	3.88a	3.23a	4.24ab	4.03a	3.84ab
W-3	3.98a	3.28a	4.59a	4.34a	4.05a
Variety average	3.85 b	2.98c	4.27a	4.24a	
1972:					
W-1	6.82	6.28	7.12	8.22	7.11 b
W-2	8.17	7.72	9.32	8.99	8.55a
W-3	7.19	7.24	9.06	8.28	7.94a
Variety average	7.39b	7.08b	8.50a	8.50a	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

yield tended to increase with increasing water. In 1971 slight negative correlations were observed for Acala 4-42 and Deltapine 16. On the Panoche soil in all years of the study Acala 4-42 and Deltapine 16 varieties showed the greatest negative correlations. Even though the Deltapine 16 variety is a relatively short-statured plant under moderate irrigation, its tendency for an exponential vegetative growth with excessive water in 1972 caused it to have the highest negative correlation. However, the relative yield depression of this variety was comparable with that of Acala 4-42.

Maturity rate

Tables 7 and 8 show the influence of the experimental variables on earliness characteristics. In 1970, earliness was determined by boll tagging twice on a small (0.001-acre) area within each plot. This procedure provided a means of measuring the amount of seed cotton set in each of three separate periods. The tendency for earliness was greatest in Deltapine 16 and Coker 310 at both locations. Increased droughtiness hastened the maturity of all varieties.

In 1971 and 1972 a technique presented by Bilbro and Quisenberry (1973) was used to evaluate earliness. This procedure results in a Production Rate Index (PRI) value calculated as follows:

$$\mathrm{PRI} = \frac{\text{total plot weight}}{\mathrm{MMD}}$$

where total plot weight is yield in pounds of lint per acre. The Mean Maturity Date (MMD) is calculated from:

$$\mathrm{MMD} = \frac{(W_1 H_1)+(W_2 H_2)+\cdots(W_n H_n)}{W_1 + W_2 + \cdots W_n}$$

where W = weight of seed cotton obtained at periodic intervals from 0.001 acre within each plot, and H = number of days from planting to harvest. Since the MMD value has units in days, the PRI is a production rate with units of pounds of lint per acre per day.

For the Hesperia soil in 1971, the PRI index showed the greatest yield-related maturity values for the W-2 treatment when averaged over all the varieties (table 8). The highest maturity rate resulted with Deltapine 16 and Coker 310. Trends were similar on the Panoche soil in 1971 and 1972 except that, averaged over all varieties, PRI was higher for the dry (W-3) treatment in 1971. Also, at the Panoche site the wet (W-1) treatment created a pronounced increased tendency for lateness (low PRI values) in the Acala 4-42 and Deltapine 16 varieties. Low PRI values for these varieties are associated with their rank growth and reduced yield with high water availability.

Boll properties

Boll size (appendix table C) not only was regulated by genetic factors but was materially influenced by water management. The two Acala varieties have larger bolls than either Deltapine 16 or Coker 310 when averaged over the three water-management treatments and locations. Boll size of the varieties was in the order Coker 310 < Deltapine 16 < Acala SJ-1 < Acala 4-42. Over all locations and years the W-2 treatment produced the largest bolls. Generally, increased drought (W-3) decreased boll size, although in some instances boll size was lower with the W-1 treatment than with W-2, and associated with excessive vegetative growth. Larger bolls observed for the W-1 treatment in some cases are probably associated with fewer bolls being set on the very vegetative plants.

Seed index, a measure of seed size, was largely controlled genetically (appendix table D), with somewhat lower values associated with the W-3 treatment. A significant variety-water management interaction at the Panoche site in 1971 resulted from a larger decrease in seed index with the Acala varieties as less water was added.

Gin turnout was affected by both variety and water management (appendix table E). Increased vegetative growth from greater additions of water was associated with more foreign material in the harvested cotton, causing lower gin turnout values in the order W-1 < W-2 < W-3. Reductions proportionately greater at the Panoche site in 1971 were for Acala 4-42 and Deltapine 16.

Fiber quality

Fiber quality was evaluated by measurements of 2.5 per cent span length, micronaire, T_1-strength, E_1-elongation, and fiber length uniformity ratio values (summarized in appendix tables F, G, H, I, and J). Figure 1 shows averages for locations and years.

Fiber length as indicated by 2.5 per cent span length values was relatively greater for Acala SJ-1 and Coker 310 than for Acala 4-42 and Deltapine 16. Less frequent irrigation reduced fiber length for all varieties. The reduction, however, was generally greater in Deltapine 16 and Coker 310 than in the two Acala varieties, as evidenced by significant interactions in 1971 and 1972, respectively, at both the Hesperia and Panoche sites.

Micronaire was generally highest for all varieties with the W-2 treatment. Lateness, associated with excessive vegetative growth, with the W-1 treatment reduced the maturity of fibers, as indicated by lowered micronaire values. A variety-irrigation interaction in 1971 on the Hesperia soil was attributable to a greater reduction in micronaire by the wet treatments for Coker 310.

Fiber strength (T_1) was appreciably higher for the two Acalas than for either Deltapine 16 or Coker 310. The

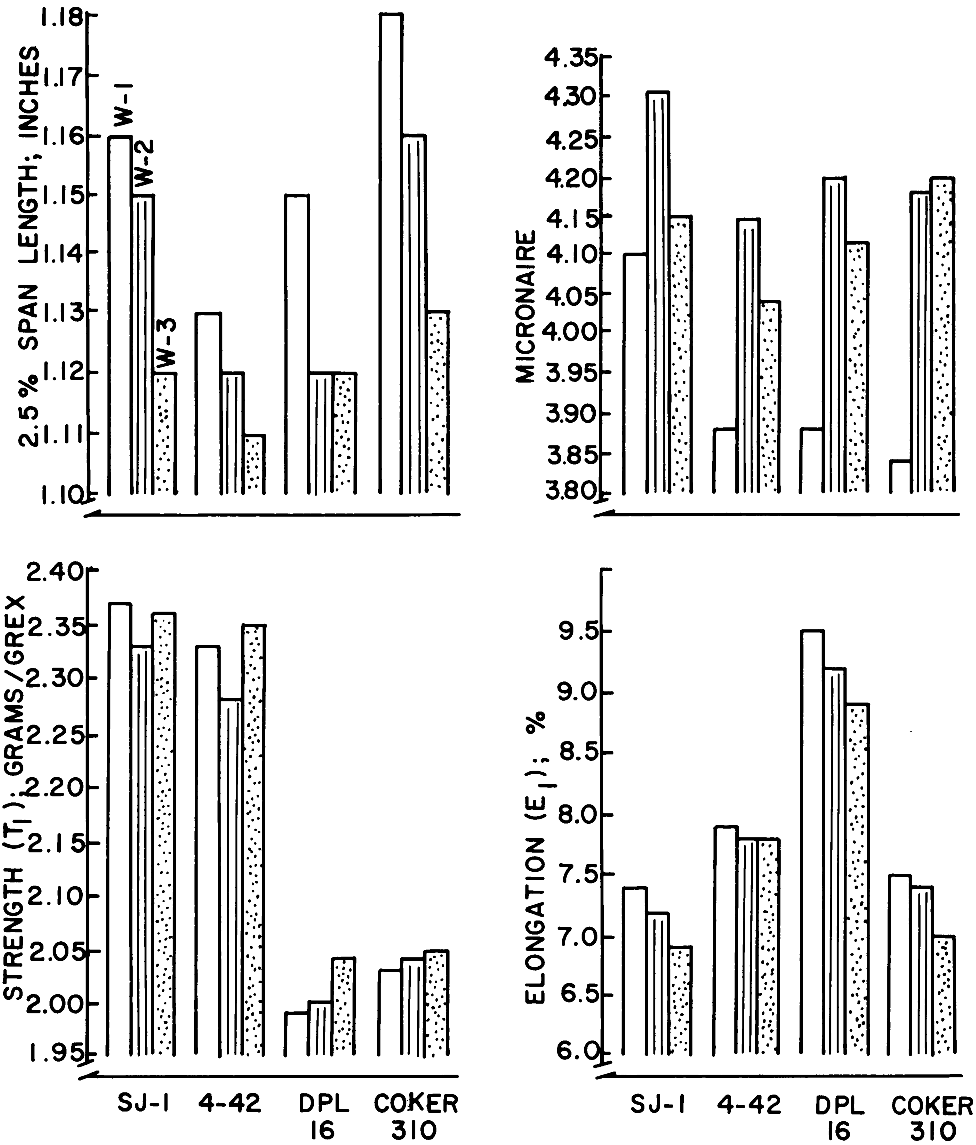

Fig. 1. Water management effects on four lint quality characteristics in four cotton varieties. Each value is an average of all locations and years of the study.

greater droughtiness (W-3) of the sandy Hesperia soil was associated with increased strength, while water management of the Panoche showed no consistent trend.

Reduced frequency of irrigation consistently lowered the elongation percentage of all varieties. Average elongation was about one to two per cent units higher in Deltapine 16 than in the other varieties.

Water management showed no consistent trend on length uniformity ratios despite some indication that less frequent irrigation may reduce the ratio slightly. The two Acalas were consistently higher in length uniformity ratio than were Deltapine 16 and Coker 310.

Plant water potential

Plant water potential for the four varieties in the W-2 treatment was monitored with a pressure chamber at the Panoche site in 1971 (fig. 2). All measurements were made between 1200 and 1500 PST when plant water potential was lowest for a diurnal fluctuation. As the soil dried at the 18-inch depth, plant water potential for all four varieties showed a rapid decrease. When varieties were considered individually, highly significant linear regressions were shown. The linear regression coefficients were considerably lower for the two Acala varieties (indicating that plant water potential decreased slower as the soil dried) than for the other varieties. An F-test indicated a real difference among the variety coefficients at a 10 per cent probability level.

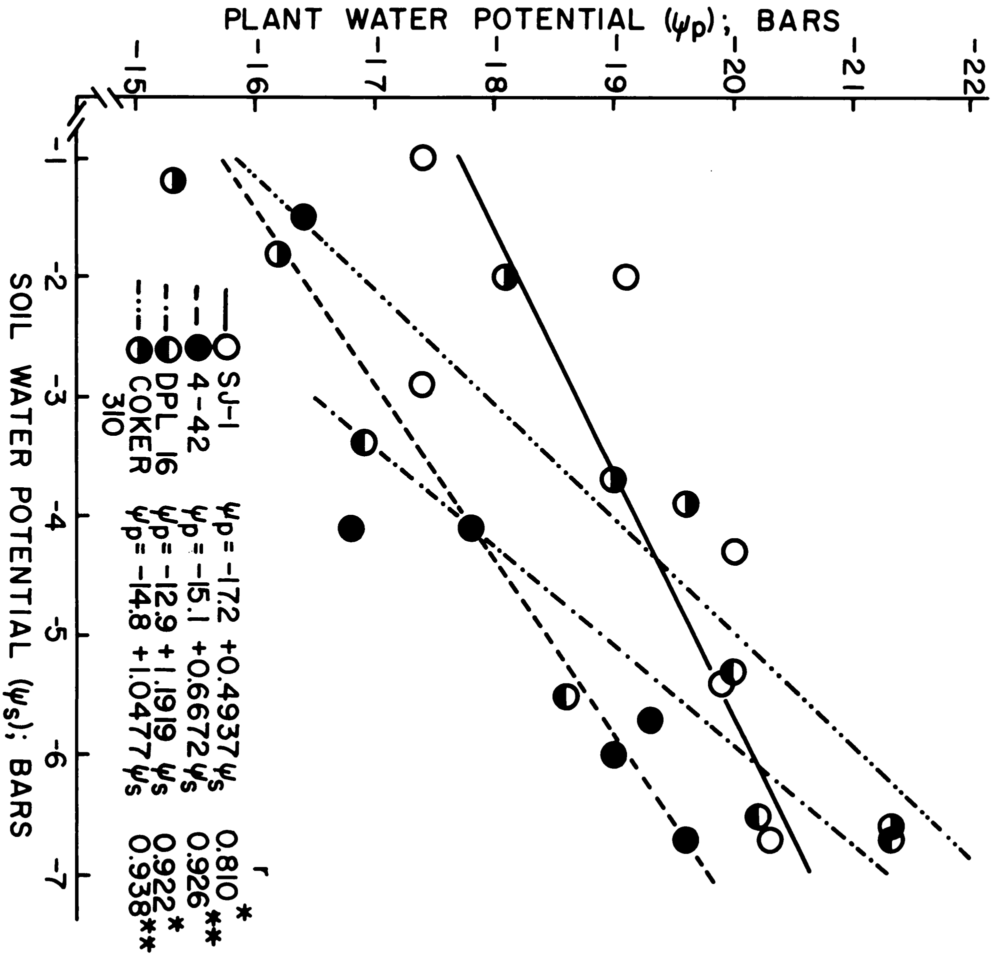

Fig. 2. Plant water potential and soil water potential at an 18-inch depth for four cotton varieties grown on a Panoche clay loam, 1971.

It is interesting to speculate on a possible reason for the slower increase in negative potential of the two Acala varieties. Root-density determinations (root intensity) indicated that the root systems of all four varieties were nearly equal and, therefore, not responsible for the different responses. (Leaf-diffusion resistance was not measured.) Assuming that the differences are real, developmental breeding of the two Acalas in the San Joaquin Valley climate may have resulted in selections of genetic materials more resistant to the high summer temperatures and lower humidities. This aspect requires further testing.

SUMMARY

Four cotton varieties of genetically different growth and fruiting habits were grown on two widely different soils under three extremes of water management. Performances of the contrasting genotypes were evaluated in terms of yields, vegetative growth, and lint quality. The varieties interacted with climate, soils, and the extremes of water management.

Low yields were associated with below-average temperatures in spring and above-average temperatures during the peak fruit-set and early boll-maturation periods. Low spring temperature was most detrimental on soils with high water retention. Yields were influenced both by water management and variety, with an intermediate irrigation treatment generally most favorable. On Hesperia sandy loam yields of Deltapine 16 were highest with the wet treatment, although water management-variety interaction was not statistically significant.

Excessive irrigation caused rank growth in all varieties, but an exponential increase in vegetative growth with increased water was most prevalent for the Deltapine 16 and Coker 310 varieties, which are usually of short stature under conditions of moderate water availability. Yield reduction, associated with increased rankness, was most severe in the Acala 4-42 and Deltapine 16 varieties.

Fiber quality was determined by water management in addition to variety. Generally, less-frequent irrigation reduced fiber length in all varieties, but reduction was greater in Deltapine 16 and Coker 310 than in the two Acala varieties. Micronaire was highest for all varieties with the W-2 (intermediate) irrigation treatment. Reduced frequency of irrigation lowered elongation percentage but generally increased fiber strength, especially on droughty sandy loam soil at Shafter.

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APPENDIX

APPENDIX TABLE A

SOURCES AND LEVELS OF SIGNIFICANCE FOR A COMBINED ANALYSIS OF LINT PRODUCTION FOR 1970 AND 1971 AT THE HESPERIA AND PANOCHE SOIL LOCATIONS*

Source of variation		Significance levels
Location	(L)	***
Years	(Y)	***
L × Y		*
Irrigations	(I)	***
Varieties	(V)	***
I × V		NS
L × I		**
L × V		*
L × I × V		NS
Y × I		NS
Y × V		***
Y × I × V		NS
L × Y × I		†
L × Y × V		***
L × Y × V × I		NS

* The symbols ***, **, *, †, and NS represent significance levels at 0.5%, 1%, 5%, 10%, and not significant, respectively.

APPENDIX TABLE B

SOURCES AND LEVELS OF SIGNIFICANCE FOR A COMBINED ANALYSIS OF VEGETATIVE PLANT HEIGHT OF COTTON FOR 1970 AND 1971 AT THE HESPERIA AND PANOCHE SOIL LOCATIONS*

Source of variation		Significance levels
Location	(L)	***
Years	(Y)	***
L × Y		***
Irrigations	(I)	***
Varieties	(V)	***
I × V		†
L × I		**
L × V		NS
L × I × V		NS
Y × I		***
Y × V		***
Y × I × V		NS
L × Y × I		***
L × Y × V		NS
L × Y × V × I		***

* The symbols ***, **, †, and NS represent significance levels at 0.5%, 1%, 10%, and not significant, respectively.

APPENDIX TABLE C

BOLL SIZE OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	boll size—g per boll				
Hesperia sandy loam:					
1970:					
W-1 (wet)	5.5a	6.0ab	4.0 b	3.4 b	4.8 b
W-2 (intermediate)	5.5a	6.4a	4.7a	4.0a	5.2a
W-3 (dry)	4.8 b	5.6 b	4.3ab	4.0a	4.7 b
Variety average	5.3b	6.0a	4.4c	3.8d	
1971:					
W-1	5.8	7.2	4.9	4.8	5.7a
W-2	6.7	6.9	5.5	4.9	6.0a
W-3	5.7	6.1	5.1	4.7	5.4 b
Variety average	6.1b	6.7a	5.2c	4.8c	
Panoche clay loam:					
1970:					
W-1	5.6a	6.1 b	4.4a	4.0a	5.0a
W-2	5.9a	6.1 b	4.2a	4.0a	5.0a
W-3	5.9a	6.7a	4.4a	3.8a	5.2a
Variety average	5.8b	6.3a	4.3c	3.8d	
1971:					
W-1	6.5	7.0	5.1	4.9	5.9a
W-2	6.0	7.0	4.9	4.8	5.8a
W-3	5.4	6.2	4.6	4.3	5.1 b
Variety average	6.0b	6.7a	4.9c	4.7c	
1972:					
W-1	7.5	8.2	5.6	5.2	6.6a
W-2	7.1	8.0	5.7	5.4	6.6a
W-3	6.4	8.0	5.9	5.5	6.5a
Variety average	7.0b	8.1a	5.7c	5.4c	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

APPENDIX TABLE D

SEED INDEX OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	seed index—g per 100 seed				
Hesperia sandy loam:					
1970:					
W-1 (wet)	13.0	12.9	10.8	10.1	11.7a
W-2 (intermediate)	13.5	13.5	11.0	10.2	12.0a
W-3 (dry)	12.6	13.0	10.4	10.2	11.6a
Variety average	13.1a	13.1a	10.7b	10.2b	
1971:					
W-1	14.5	14.6	11.3	11.3	12.9a
W-2	14.5	14.7	11.7	11.7	13.1a
W-3	14.1	14.3	11.2	11.8	12.9a
Variety average	14.4a	14.5a	11.4b	11.6b	
Panoche clay loam:					
1970:					
W-1	12.9	13.0	10.3	9.5	11.4a
W-2	13.1	12.7	10.0	9.8	11.4a
W-3	12.6	12.5	9.8	9.3	11.1a
Variety average	12.9a	12.8a	10.0b	9.5c	
1971:					
W-1	14.2a	14.1a	10.6a	10.6ab	12.4a
W-2	13.8a	13.0 b	10.6a	10.9a	12.1 b
W-3	13.2 b	12.3 c	10.1 b	10.4 b	11.5 c
Variety average	13.7a	13.1b	10.4c	10.6c	
1972:					
W-1	14.4	13.9	11.0	11.3	12.7a
W-2	14.4	14.2	10.9	11.1	12.7a
W-3	13.6	13.1	10.8	10.5	12.0 b
Variety average	14.1a	13.7b	10.9c	11.0c	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

APPENDIX TABLE E

GIN TURNOUT OF FOUR COTTON VARIETIES GROWN UNDER WIDE VARIATIONS OF WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	per cent				
Hesperia sandy loam:					
1970:					
W-1 (wet)	26.51	30.20	28.84	29.20	28.69 b
W-2 (intermediate)	27.98	31.37	29.51	30.25	29.77a
W-3 (dry)	27.11	30.78	28.31	29.64	28.96 b
Variety average	27.20d	30.78a	28.89c	29.69b	
1971:					
W-1	26.96	29.24	30.24	31.71	29.54 c
W-2	27.93	30.53	30.64	31.61	30.18 b
W-3	27.99	31.63	31.56	33.04	31.05a
Variety average	27.63c	30.47b	30.81b	32.12a	
Panoche clay loam:					
1970:					
W-1	30.13	32.22	31.76	31.42	31.38 c
W-2	30.04	33.70	32.32	32.34	32.10 b
W-3	31.45	34.11	33.09	33.50	33.04a
Variety average	30.54c	33.34a	32.39b	32.42b	
1971:					
W-1	29.36a	31.42 b	31.62 c	32.85 b	31.31 c
W-2	29.96a	32.17 b	32.87 b	32.52 b	31.88 b
W-3	30.14a	34.15a	34.05a	34.83a	33.29a
Variety average	29.82c	32.58b	32.85ab	33.40a	
1972:					
W-1	27.25	30.94	29.85	30.45	29.62 b
W-2	28.16	30.38	32.20	30.11	30.21 b
W-3	30.01	32.86	34.01	33.42	32.58a
Variety average	28.47b	31.39a	32.02a	31.33a	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

APPENDIX TABLE F

FIBER LENGTH (2.5 PER CENT SPAN LENGTH) OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
Hesperia sandy loam:	2.5% span length† (inches)				
1970:					
W-1 (wet)	1.17	1.14	1.14	1.19	1.16a
W-2 (intermediate)	1.14	1.11	1.12	1.17	1.14 b
W-3 (dry)	1.12	1.11	1.14	1.17	1.14 b
Variety average	1.14b	1.12c	1.13bc	1.18a	
1971:					
W-1	1.18a	1.15a	1.17a	1.18 b	1.17a
W-2	1.17a	1.15a	1.16a	1.20a	1.17a
W-3	1.17a	1.15a	1.14 b	1.14 c	1.15 b
Variety average	1.17a	1.15b	1.15b	1.17a	
Panoche clay loam:					
1970:					
W-1	1.12	1.11	1.13	1.15	1.13a
W-2	1.12	1.08	1.10	1.13	1.11 b
W-3	1.10	1.09	1.10	1.11	1.10 c
Variety average	1.11b	1.10c	1.11b	1.13a	
1971:					
W-1	1.14	1.13	1.13	1.15	1.14a
W-2	1.13	1.11	1.11	1.13	1.12 b
W-3	1.11	1.08	1.07	1.10	1.09 c
Variety average	1.13a	1.10c	1.10c	1.12b	
1972:					
W-1	1.18a	1.14a	1.16a	1.21a	1.17a
W-2	1.18a	1.14a	1.13 b	1.19a	1.16 b
W-3	1.12 b	1.10 b	1.13 b	1.13 b	1.12 c
Variety average	1.16b	1.13c	1.14c	1.18a	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

†Length in inches of a test sample spanned by 2.5 per cent of the fibers scanned at the initial starting point on a digital fibrograph.

APPENDIX TABLE G

MICRONAIRE VALUES OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	micronaire†				
Hesperia sandy loam:					
1970:					
W-1 (wet)	3.55	3.33	3.60	3.19	3.42 b
W-2 (intermediate)	3.68	3.99	3.86	3.42	3.74a
W-3 (dry)	3.22	3.35	3.22	3.19	3.24 b
Variety average	3.48a	3.56a	3.56a	3.26a	
1971:					
W-1	3.95a	3.85a	3.94a	3.86 b	3.90a
W-2	4.16a	3.87a	4.16a	4.33 b	4.13a
W-3	3.77a	3.83a	4.07a	4.88a	4.14a
Variety average	3.96b	3.85b	4.06ab	4.36a	
Panoche clay loam:					
1970:					
W-1	4.40	4.07	3.80	3.55	3.96 b
W-2	4.54	4.19	3.97	3.85	4.14a
W-3	4.48	4.27	4.14	3.83	4.18a
Variety average	4.47a	4.18b	3.97c	3.75d	
1971:					
W-1	4.66	4.40	4.50	4.73	4.57 b
W-2	4.78	4.38	4.67	4.82	4.66 b
W-3	4.76	4.50	4.89	4.95	4.78a
Variety average	4.73ab	4.43c	4.69b	4.83a	
1972:					
W-1	3.95	3.77	3.58	3.88	3.80 b
W-2	4.40	4.25	4.33	4.50	4.37a
W-3	4.50	4.23	4.25	4.15	4.28a
Variety average	4.28a	4.08a	4.05a	4.18a	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. The absence of letters within the 2-way table indicates a nonsignificant interaction by the F-test. Where a significant interaction is observed, the appropriate comparison is irrigation means within varieties.

† Fineness of a sample of ginned lint measured by the micronaire and expressed in standard (curvilinear scale) micronaire units.

APPENDIX TABLE H

FIBER STRENGTH OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	T_1—strength† *(g per grex)*				
Hesperia sandy loam:					
1970:					
W-1 (wet)	2.24	2.27	1.97	1.94	2.11 b
W-2 (intermediate)	2.19	2.14	1.97	1.99	2.07 c
W-3 (dry)	2.21	2.26	2.09	2.07	2.16a
Variety average	2.21a	2.22a	2.01b	2.00b	
1971:					
W-1	2.44	2.41	2.00	2.09	2.23 b
W-2	2.46	2.39	2.12	2.12	2.27 b
W-3	2.57	2.54	2.10	2.15	2.34a
Variety average	2.49a	2.45a	2.07c	2.12b	
Panoche clay loam:					
1970:					
W-1	2.41	2.35	2.10	2.11	2.24a
W-2	2.32	2.28	1.98	2.15	2.18a
W-3	2.39	2.35	2.08	2.01	2.21a
Variety average	2.37a	2.33a	2.06b	2.09b	
1971:					
W-1	2.50	2.45	2.01	2.04	2.25a
W-2	2.41	2.42	2.02	1.98	2.21a
W-3	2.42	2.32	1.98	2.03	2.19a
Variety average	2.45a	2.40a	2.00b	2.02b	
1972:					
W-1	2.26	2.15	1.88	1.96	2.06a
W-2	2.27	2.19	1.93	1.97	2.09a
W-3	2.21	2.30	1.93	1.97	2.10a
Variety average	2.25a	2.21a	1.91c	1.97b	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. No significant interaction was observed.

† Fiber strength (grams per grex) of a bundle of fibers measured on the stelometer with the two jaws ⅛-inch apart.

APPENDIX TABLE I

ELONGATION PER CENT (E_1) OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	E_1—*elongation*† (%)				
Hesperia sandy loam:					
1970:					
W-1 (wet)	8.3	9.0	10.6	8.8	9.2a
W-2 (intermediate)	7.8	9.1	10.5	8.7	9.0a
W-3 (dry)	7.3	9.0	10.3	8.8	8.9a
Variety average	7.8c	9.0b	10.5a	8.8b	
1971:					
W-1	7.6	8.0	9.1	7.1	8.0a
W-2	7.0	7.7	9.1	7.3	7.8ab
W-3	7.1	7.5	9.0	7.0	7.6 b
Variety average	7.2c	7.7b	9.1a	7.1c	
Panoche clay loam:					
1970:					
W-1	6.6	7.2	8.7	6.9	7.3a
W-2	6.7	7.4	8.7	6.5	7.3a
W-3	6.2	7.2	8.6	6.5	7.1a
Variety average	6.5c	7.2b	8.7a	6.7bc	
1971:					
W-1	7.1	7.5	9.4	6.8	7.7a
W-2	7.1	7.2	8.4	7.0	7.4ab
W-3	6.8	7.6	8.2	6.0	7.1 b
Variety average	7.0bc	7.4b	8.7a	6.6c	
1972:					
W-1	7.5	8.0	9.7	8.1	8.3a
W-2	7.3	7.8	9.3	7.4	8.0ab
W-3	7.3	7.8	8.5	6.8	7.6 b
Variety average	7.4b	7.9b	9.2a	7.4b	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. No significant interaction was observed.
† Per cent elongation at break of the fibers measured for T_1—strength.

APPENDIX TABLE J

UNIFORMITY RATIOS OF FOUR COTTON VARIETIES GROWN WITH WIDE VARIATIONS IN WATER MANAGEMENT ON TWO CONTRASTING SOILS*

Soil type and irrigation treatment	Cotton variety				Irrigation average
	SJ-1	4-42	DPL-16	Coker 310	
	uniformity ratio†				
Hesperia sandy loam:					
1970:					
W-1 (wet)	46	45	43	41	44a
W-2 (intermediate)	45	47	44	41	44a
W-3 (dry)	44	44	42	41	43 b
Variety average	45a	45a	43b	41c	
1971:					
W-1	50	50	47	46	48 b
W-2	50	51	48	48	49a
W-3	50	49	46	48	48 b
Variety average	50a	50a	47b	47b	
Panoche clay loam:					
1970:					
W-1	46	47	43	41	44a
W-2	47	46	43	42	44a
W-3	47	46	43	41	44a
Variety average	47a	46b	43c	41d	
1971:					
W-1	50	51	47	47	49a
W-2	50	50	47	47	49a
W-3	50	49	47	47	48a
Variety average	50a	50a	47b	47b	
1972:					
W-1	46	47	43	43	45a
W-2	46	47	44	44	45a
W-3	47	46	43	43	45a
Variety average	46a	47a	43b	43b	

* Averages for irrigations or varieties not followed by the same letter differ at the 0.05 probability level according to Duncan's multiple-range test. No significant interaction was observed.

† Ratio (expressed as per cent) of the 50 per cent span length and 2.5 per cent span-length values.

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