



a new cotton variety *for southern California*

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Acala Imperial, released in 1967, provides southern California growers with a cotton variety capable of producing high yields of a high-quality fiber that is in demand by domestic textile mills. Commercial sales in the fall of 1967 verified this market demand: *Acala Imperial* brought growers a premium of 5¢ to 7¢ per pound more than the *Deltapine Smooth Leaf* variety from the same area.

THE long growing season is a major factor in the production of extremely high cotton yields in the valleys of southern California. Flowers developing from early June to mid-October produce open bolls for harvest—a total of about 120 days of effective flowering, compared with 60 to 70 days in most areas. The valleys of southern California and the lower Colorado River Valley differ ecologically from any other cotton-growing area in the United States, not only in the length of growing season but also because of the high temperatures.

Breeding and testing research for cotton varieties adapted to the southern California climate and culture have been continuous since 1953—in a cooperative endeavor by the Crops Research Division, Agricultural Research Service, USDA; the California Agricultural Experiment Station and the Agronomy Department, University of California. Breeders at the U.S. Cotton Research Station, Shafter, and at the Southwest Irrigation Field Station, Brawley, have selected and evaluated numerous lines for specific adaptation to southern California conditions. While striving to develop a variety with improved agronomic adaptation, researchers also aimed at retaining the superior fiber qualities found in the western *Acala* varieties. Germ plasm from many sources was used in hybridizing, and many methods of selection were used in the attempt to combine the agronomic traits contributing to high yield with the fiber quality of the *Acalas* into a new variety.

In 1959, one plot at the Brawley station was outstanding in producing the desired plant and fiber traits. This plot was a trial planting of a partial hybrid population, known as "Hybrid X"—the product of natural cross pollination between A × TE-1 and Cal. 7-5. A 50-50 mixture of

plants of those two experimental strains had been exposed to bee pollination in the San Joaquin Valley the two previous seasons. Yield tests in 1960-62 provided comparisons between this partial hybrid (Hybrid X was relabeled "Strain A") and commercial varieties. Seed cotton production of this strain was equal to the best varieties and fiber quality was satisfactory. However, because of the extremely low gin turn-out, the lint yield per acre of this original Strain A was somewhat lower than that of the leading commercial variety (*Acala 4-42*).

The heterozygous status of most traits in the population of this strain suggested that gin turn-out might be improved, without altering other characters greatly, through a relatively simple reselection effort. In 1961, some 300 plant selections were made from two fields (one near the Brawley station and one near the Shafter station). After screening these selections for improved gin turn-out and other desirable agronomic and fiber traits, there were 54 sib-lines chosen for entry in yield-performance tests. Data for yield and quality comparisons were obtained from tests in 1962 and 1963—including ratings for gin turn-out, boll size, stalk erectness, and crop maturity. Many of the 54 lines compared favorably with the commercially grown check variety for yield, but only 15 lines possessed the fiber traits approaching *Acala 4-42* quality. After considering yield, quality, plant erectness and gin turn-out, the best 10 of these lines were chosen to use in a seed composite for increase and testing. This composite was made in the spring of 1964 and designated as "Strain A 64." Following three years of yield trials and fiber quality tests, this strain was released for southern California growers in February, 1967, and given the varietal name "*Acala Imperial*."

The release of *Acala Imperial* seed for use in southern California was made on the basis of yield and quality data obtained in the three-year period, 1964-1966. *Acala Imperial* was compared with the commercially grown (*Deltapine Smooth Leaf*) variety in 11 *Imperial Valley* tests for yield and fiber quality. *Acala 4-42* was also included in some of these tests to serve as a comparison for fiber quality. Lint yield comparisons for the three-year period are shown in table 1. The average lint yield was highest for *Acala Imperial* in 1964 and 1965; *Deltapine Smooth Leaf* was highest in 1966. Statistical analyses fail to show any significant difference in the lint yield between these two varieties for either year. *Acala 4-42* yielded less lint than the *Acala Imperial* in all eight tests.

The fiber-quality data gained from the three-year comparisons of *Acala Imperial*, *Deltapine Smooth Leaf* and *Acala 4-42* are given in table 2. Fiber length, length uniformity, fineness and the strength of spun yarn are the important measurements considered by merchants and textile-mill consumers. These data represent yearly mean values for each variety as obtained by testing two samples for each entry from each test site at the US Fiber and Spinning Laboratory, Knoxville, Tennessee. *Acala Imperial* had longer, more uniform fiber length and higher yarn strength than the *Deltapine Smooth Leaf* check in all tests—and quality of fiber compared favorably with that of the *Acala 4-42* check.

Boll and seed-size data, and also the lint-seed ratios for *Acala Imperial* and the two varietal checks are shown in table 3. The data for boll size, seed size, and percentage of lint were derived from two samples per year for each variety. The gin turn-out percentage shown in table 3 is an average value for all tests for the

TABLE 1. COMPARATIVE YIELDS, OF ACALA IMPERIAL, DELTAPINE SMOOTH LEAF, AND ACALA 4-42, IN ELEVEN TESTS OVER A THREE-YEAR PERIOD IN THE IMPERIAL VALLEY

Variety	Brawley station Varieties	Meloland station Strains	Wuytens ranch	Fifield ranch	Average yields
1964 yields in pounds per acre (5 tests)					
Acala Imperial	1760 a*	1549 a	1048	2246	2130
Deltapine Smooth Leaf	1332 b	1122 c	1068	2313	2070
Acala 4-42	1332 b	1354 b	965	N. S.	N. S.
1965 yields in pounds per acre (3 tests)					
Acala Imperial	1950 a	2037 a	1174	1717	1606
Deltapine Smooth Leaf	1610 c	1937 a	1270	1606	1606
Acala 4-42	1766 b	1633 c	1001	N. S.	N. S.
1966 yields in pounds per acre (3 tests)					
Acala Imperial	1054 a	1175 a	577 b	935	935
Deltapine Smooth Leaf	1048 a	1124 a	730 a	967	967
Acala 4-42	864 b	976 b	—	—	N. S.

* Differences significant if values are not followed by a common letter.

TABLE 3. THREE-YEAR (1964-66) MEAN VALUES FOR BOLL SIZE, SEED SIZE, AND LINT-SEED RATIOS AND GIN TURN-OUT OF ACALA IMPERIAL, DELTAPINE SMOOTH LEAF AND ACALA 4-42

Variety	Boll Size*	Seed Size*	Lint*	Gin† turn-out
	gm/boll	gm/100 seed	%	%
Acala Imperial	6.21	12.0	34.6	32.01
Deltapine Smooth Leaf	5.51	10.1	36.5	33.90
Acala 4-42	7.43	13.4	36.5	35.46

* Mean from two samples per year only.

† Mean from four samples for each of the eleven tests over the three-year period.

three-year period. The weight of seed cotton per boll and the weight per 100 seeds for Acala Imperial were greater than for Deltapine Smooth Leaf. The Acala 4-42 variety has a larger boll and larger seed than either the Acala Imperial or the Deltapine Smooth Leaf. Acala Imperial has a lower ratio of lint to seed weight than either Deltapine Smooth Leaf or Acala 4-42, whether measured as lint percentage (from clean, hand-picked samples) or measured as percentage of gin turn-out (from machine-picked samples).

Cotton bolls mature and open from late July until mid-December under the long growing season of Imperial County. In recent years, practically all growers have waited until the crop could be machine harvested. For picking machines to operate efficiently, approximately three-fourths of the bolls should be open. Hence, the early crop of open bolls is subjected to late-summer boll rots and field deterioration until November or December while the top crop of fruit is developing. The data shown in table 4 were gained from hand pickings made in 1965 from early August through November. These data are from only one field test, but research observations made for several past years indicate that the relative rate of boll opening shown here is a reasonable estimate for average crop seasons in the southern California valleys. It can be seen that the Deltapine Smooth Leaf variety had a

higher percentage of its total crop open by August or September than the Acala Imperial in this test. However, this difference may be of minor consequence when machine harvesting is delayed until November to avoid losses in yield and fiber quality. A more comprehensive study of crop maturity and harvest procedures is necessary in view of the new regulations (plow-down date) imposed because of the recent pink bollworm infestation.

Under southern California growing conditions, Acala Imperial has shown excellent seedling emergence and vigor, enabling growers to obtain and maintain early stands of healthy cotton plants. It is able to retain more mid-season fruit than the other Acala varieties tested in this area. Like other Acalas, it requires less frequent irrigation than do the rain-belt-developed varieties.

The green bolls of Acala Imperial are larger than those of the Deltapine Smooth Leaf, and the boll maturation period is somewhat shorter for mid- and late-season flowers. Mature plants of Acala Imperial are larger in all respects than the Deltapine Smooth Leaf plants. Fruiting limbs are well off the ground, minimizing boll rots and permitting more efficient machine harvest. Stalks are stiff and remain erect unless excessive applications of water and nitrogen are made.

Acala Imperial is not as tolerant to Verticillium wilt as other western-grown

TABLE 2. MEAN VALUES FOR FIBER AND SPINNING PROPERTIES OF THREE COTTON VARIETIES BY YEARS (KNOXVILLE LABORATORY DATA)

	Length, inches	Length‡ U.I.	Fineness	Strength
1964 Data*				
Acala Imperial	1.12	46	4.5	132
Deltapine Smooth Leaf	1.10	43	4.3	110
Acala 4-42	1.14	46	4.3	139
1965 Data*				
Acala Imperial	1.15	45	4.2	139
Deltapine Smooth Leaf	1.12	42	4.2	115
Acala 4-42	1.14	46	4.0	140
1966 Data*				
Acala Imperial	1.11	47	4.3	127
Deltapine Smooth Leaf	1.09	43	4.3	109

* 1964 data are mean values from 8 samples for each variety; 1965 data are mean values from 6 samples for each variety; 1966 data are mean values from 4 samples for two varieties.

† Fibrograph measure of length for 2.5% of fibers scanned. This approximates a classer's staple.

‡ Length Uniformity Index = $\frac{50\% \text{ span}}{100\% \text{ span}}$

TABLE 4. CROP MATURITY ESTIMATES (1965) FOR ACALA IMPERIAL AND DELTAPINE SMOOTH LEAF

Variety	Cumulative percentage of total yield harvested by monthly dates				
	Aug. 9	Sept. 6	Oct. 11	Nov. 8	Dec. 13
Acala Imperial	20	41	57	73	97
Deltapine Smooth Leaf	18	54	70	77	96

Acala varieties, and is therefore not recommended for areas with cooler climates. When grown in the hot valleys of southern California, Acala Imperial produces fiber that meets the spinning requirements of the same textile mills as other Acalas.

This newly released Acala was planted on several thousand acres in 1967. The Imperial County Cotton Seed Improvement Association assumed the job of seed distribution. Approval for variety certification through the California Crop Improvement Association was obtained and the pure seed growers in the Association have been able to save an excellent supply of certified seed from the crop.

Maintenance and improvement of Acala Imperial and its component lines continue as functions of the breeding program at the US Cotton Research Station at Shafter and at the Southwest Irrigation Field Station at Brawley.

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