

**PIMA COTTON BREEDING**  
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**Abstract**

Pima cotton has been grown in the southwestern USA since the early 20<sup>th</sup> century. It originated from extra-long staple introductions from Egypt. The introductions had long, strong and fine fiber, and were very tall, late maturing and unproductive. In the early 1900's, Pima cultivar development was either by direct selection from the introductions or through hybridization followed by selection. Cultivar improvements up through the release of 'P32' in 1949 by R. H. Peebles at the USDA Field Station at Sacaton, AZ, were minimal because of the narrow genetic base of the germplasm.

About 50 years ago, the potential for Pima improvement was greatly enhanced. 'Pima S-1' released in 1951 by W. E. Bryan at the University of Arizona differed considerably from previous Pima cultivars. It was developed in a much different manner. Pima S-1 was selected from a series of crosses involving Sea Island, Pima, Tanguis, and Stoneville. The first three were *Gossypium barbadense* from different centers of variability, while the latter was *G. hirsutum*, which contributed to cultivar development through some introgression.

Pima S-1 gave a striking increase in yield over its predecessor, P32. It was earlier and had shorter plants than P32. The fiber of Pima S-1 was shorter and coarser than that of P32, but it gave a yarn strength greater than expected from its fiber properties.

Pima S-1 was a new base in the Pima improvement effort. The germplasm pool from which Pima S-1 was selected had variability ranging from almost *G. hirsutum* types to P32 types. Beginning in the 1950's, the USDA Pima breeding program in Arizona utilized crosses involving the germplasm pool from which Pima S-1 was developed and the germplasm pool from which P32 was developed. Selections from these crosses led to a series of cultivars released after 1959. The last two releases, 'Pima S-6' and 'Pima S-7', also had germplasm from hybrid B developed in West Texas. Hybrid B was from similar parentage as that of Pima S-1. Pima S-3 was selected from the hybrid B germplasm and was released in 1966 from the USDA program at El Paso. It was tall, late maturing and was grown for a short time on some of the less productive soils at high elevation.

Each succeeding cultivar developed in Arizona was more heat tolerant, earlier maturing, shorter statured, and more productive (Table 1). Since each subsequent cultivar had greater heat tolerance, yield increases generally were greater at low elevations where temperatures are higher than at the high elevations. Fruiting height index, the height measurement at which appreciable boll set begins, was utilized for evaluating heat tolerance under different environments.

The fiber quality of each succeeding cultivar was equal or superior to the previously released cultivar.

Practically all growers who produce Pima also produce upland. The grower's decision to grow or not to grow Pima depends primarily on the price of Pima relative to the price of upland, and the grower's potential yields of Pima and upland. Historically, the price of Pima has averaged about 50% higher than the price of upland. The price differential has narrowed somewhat in recent years. In Arizona, New Mexico, and West Texas, the relative yields of Pima and upland depend largely on the environments associated with elevation. Pima yields average about 60-70% of upland yields at low elevation and 75-85% at high elevation. The low elevations (below 1500') include central Arizona and along the Colorado River in Arizona. The high elevations (about 2500') include eastern Arizona, New Mexico, and West Texas.

Until recently, the Pima belt included only Arizona, New Mexico, and West Texas. In the mid-1980's, a few growers in the San Joaquin Valley of California became interested in growing Pima. It was grown on an experimental basis in the beginning, since the one-quality law in the San Joaquin did not permit the commercial production of cottons other than Acala cotton. Early on, Pima yielded well relative to upland. Interest in growing Pima in the San Joaquin increased, and the one-quality law was amended to allow the growing of Pima commercially.

In 1990, about 25,000 acres of Pima were grown in the San Joaquin. The acreage has increased to an estimated 184,000 acres in 1997. In the San Joaquin from 1990 through 1996, the average Pima yield of 1,103 pounds/acre was 91% of the average Acala yield. The higher price for Pima compared with that for Acala went a long way toward offsetting the approximate 10% lower yield for Pima. The Pima yield of 1,103 pounds/acre for 1990-96 in the San Joaquin was appreciably higher than for Arizona (767), Texas (735), and New Mexico (681).

There has been a tremendous shift in production areas for Pima. In 190, California accounted for 16% of the total U.S. production. In 1997, it is estimated to account for about 80% of the U.S. Pima production. As the Pima acreage in California has increased, the acreage in central Arizona, where Pima yields are less competitive with upland yields, has decreased.

When Pima moved into the San Joaquin, Pima S-6 was the major cultivar grown. Pima S-7 was released in 1991. Pima S-7 was the last cultivar released from the USDA breeding program, which was terminated in 1993. A wide range of germplasm from the USDA program has been released and is being utilized in private Pima breeding programs initiated since the 1980's. To date, several cultivars have been released by the private sector.

### **Summary**

Over the past 50 years, a much broadened germplasm base has resulted in the release of a series of improved Pima cultivars.

There has been a major change in areas of production. The area of increased production is in California where Pima yields are high and the differences between Pima and Acala

yields are relatively narrow. The increase in Pima acreage in the San Joaquin has occurred in spite of a lower price premium for Pima relative to Acala than the historical 50% margin between Pima and upland.

Since the mid-1980's, Pima exports have increased dramatically along with the expanded Pima belt.

Table 1. Estimated changes in yield potential from successive Pima cultivar releases, 1960-1991.

	Elevation		Date of Cultivar Release <sup>1</sup>
	Below 1500 ft	Above 2500 ft.	
	%	%	
S-2 vs. S-1	+25	+10	1960
S-4 vs. S-2	+17	0	1966
S-5 vs. S-4	+17	+12	1975
S-6 vs. S-5	+12	+15	1983
S-7 vs. S-6	+10	-4	1991

<sup>1</sup>Release date applied to cultivar shown at far left in first column.