Cotton Production in California

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Background

The cotton plant was introduced to California from Mexico by missionary padres. Some of the first attempts to grow cotton at the missions date back to the early 19th century. These efforts had mixed success due to the cool climate along the coast [5]. The missionaries' motive to produce cotton and raise sheep was mainly to provide clothing for the mostly naked Indians, an intolerable situation for the missionaries. For early manufacturing of clothes, cotton was imported from Mexico. By the 1840s, however, cotton was established in California and was also cultivated by settlers. Numerous reports from that period praise the high quality of California cotton [5].

Continuous commercial production began in the early 20th century in the Imperial Valley. The high demand during World War I caused a cotton boom and production was extended to the San Joaquin Valley. While boll weevil infestations severely affected cotton production in the traditional regions of the South, the arid West was not affected. This resulted in a strong expansion of long-staple cotton production in California, which was supported by the USDA [6].

Based on work by W.B. Camp, a USDA agronomist, state legislature passed laws in 1925 that limited the cotton production in the San Joaquin Valley to one Acala strain [6]. These laws, in effect until 1978, prevented high-quality cotton from cross-pollination with inferior strains. The one-variety community also facilitated marketing, and increased yields [2, 6]. During these years, government policies and research programs played a crucial role in cotton production in California.

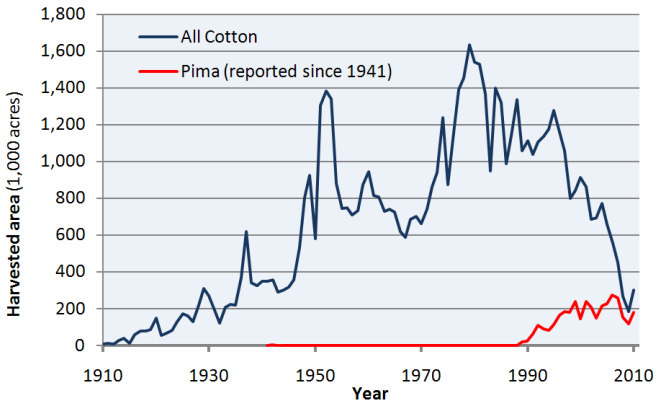

Figure 1: Harvested cotton acreage in California since 1911 [7, 10].

Production area

The area planted to cotton in California has changed considerably over the course of the last century. The production area reached a peak in the late 70s, early 80s, when 1.4 to 1.6 million acres were harvested each year (Figure 1). During the same period, the total U.S. cotton acreage tended to decrease, so that California's share increased between 1920 and 1980 from 0.4 to 12% [7, 10]. Several reasons were responsible for the popularity of cotton in California:

The environmental conditions, namely fertile soils, warm climate and controlled application of water through irrigation were favorable for cotton production resulting in yields that were much higher than those of the U.S. average.

The dry summer climate kept weed and pest pressure low compared to the South.

Furthermore, the agricultural structure in California favored early adoption of mechanization (see below).

Beginning in the early 1980s, the cotton production area in California declined dramatically to below 0.2 million acres in 2009 [10]. The area planted to cotton had not been so small since 1932. Several factors led to the decline in cotton production in California: Drought conditions which limited water availabilities in the southern San Joaquin Valley, increased water costs, and increased severity of pests, such as pesticide resistant pink bollworm and sweet potato whitefly. While these factors made the cotton production less lucrative, other commodities became more interesting [4, 1]. As an example, in Fresno county, historically the county with the largest area planted to cotton in California, the acreage of almonds, grapes and processing tomatoes increased considerably since the 1970s, while the cotton area decreased (Figure 2) [3].

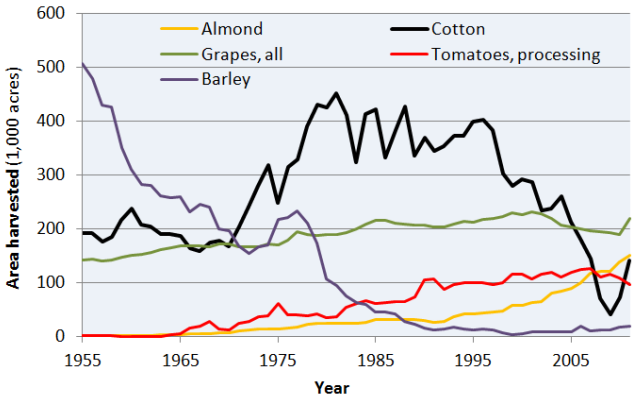

Figure 2: Harvested area of selected crops in Fresno county 1955-2011 [3].

While in the 1980s practically all the cotton produced in California was upland cotton (*Gossypium hirsutum*), Pima cotton (*Gossypium barbadense*) production has become increasingly important (Figure 1). The area planted to Pima cotton, which produces an extra-long staple, increased from 900 acres in 1987 to about 200,000 within ten years. Since 1997, the Pima cotton acreage has somewhat fluctuated, but remained at around 200,000 acres. Pima cotton now accounts for more than 50% of the cotton area [7, 10].

While continuous commercial cotton production began in the Imperial Valley, more than 90% of the cotton acreage harvested in California has generally been located in the five San Joaquin Valley counties of Fresno, Kern, Kings, Merced and Tulare since the 1960s (Figure 3) [9].

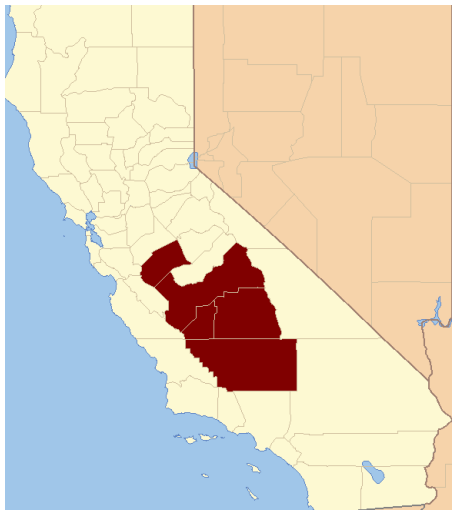

Figure 3: Location of the five leading cotton producing counties in California [9].

Lint yield

The soils and climate in California are favorable for cotton production resulting in yields that were at least twice those of the U.S. average between the mid-1920s and the 1970s. Even today, California's yields are close to twice as high as the U.S. average (Figure 4). The lint yield of upland cotton harvested in California has been steadily increasing since 1920 by close to 12 lbs/acre a year (Figure 4). During the five-year period from 2007 to 2011, California's cotton growers harvested an average of 1,535 lbs lint/acre. In comparison, the U.S. average was 804 lbs/acre during the same period [7, 10].

Mechanization

The cotton acreage per farm in California was among the highest in the nation in the 1930s and 40s. The large area cultivated by cotton growers favored mechanization. Furthermore, the use of tractors for pre-harvest operations was much more common in California than in the South. The mechanical skills and attitudes towards the use of machines paved the way for an early and fast adoption of the mechanical cotton picker in California [6].

Introduced in the early 1940s in California, the cotton picker quickly gained acceptance. While 20 mechanical pickers were operated in California in 1945, their number increased to 3,700 by 1951, harvesting more than half of the cotton produced. By 1960, more than 90% of the cotton produced in California was mechanically harvested, while the U.S. average for the same year was just above 50%. The mechanical picker considerably reduced the costs per bale harvested. However, the shift from hand picking to the mechanical harvester did not proceed without frequent and often violent labor disputes [6].

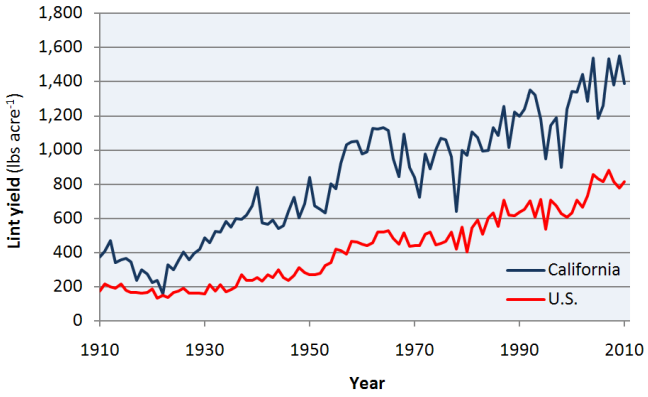

Figure 4: Lint yield for upland cotton since 1911 in California and the U.S. [7, 10].

Fertilization

Between 1990 and 2005, nitrogen application rates to upland cotton averaged 150 lbs/acre [8]. The application ranged between 125 and 200 lbs/acre with a large year to year variability (Figure 4). During the same period, the average potassium application rate was 64 lbs K_2O/acre, and the phosphorus application rate 68 lbs P_2O_5/acre [8]. While the application rate of phosphorus remained relatively stable over time, the application rate of potassium increased from 40 to 90 lbs K_2O /acre. Nitrogen was applied on 97% of the cotton acreage, while phosphorus and potassium were applied on only 33 and 15% of the area planted to cotton [8].

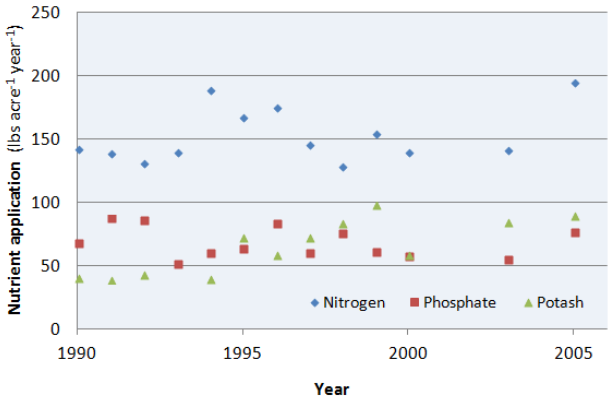

Figure 5: Fertilizer use for upland cotton in California [8].

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