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Production of Processing Tomatoes in California

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Background

In the early 20th century, processing tomatoes were mainly produced in the eastern U.S. with the leading states being New Jersey, Maryland and Indiana. At that time, the shipping costs from these states to the major markets in the East and Midwest were considerably lower than those for tomatoes produced in California [15]. Despite this disadvantage, production was considerably expanded in California in the 1940s and 1950s (Figure 1). Some of the factors contributing to the increase in production were higher productivity on irrigated land, progress due to research at the University of California and the availability of cheap labor from Mexico [15].

By the end of the 1950s, however, it became apparent that the Bracero Program, which supplied growers in California with seasonal workers from Mexico, was not being extended indefinitely. In fact, the program was abolished in 1964. Facing a potential future shortage of tomato pickers, tomato growers sought a solution [15]. Research on the mechanization of tomato harvest, which had begun during World War II, now gained the full support of the industry.

For the development of a mechanical tomato harvester, a systems approach was necessary. The widespread adoption of the mechanical harvester was only possible with changes in crop management and the introduction of tomato varieties suitable for mechanical harvest [8]. In addition to being resistant to bruising, tomatoes for mechanical harvest need to ripen uniformly and detach from the plant during harvest [10]. Scientists from different departments at the University of California at Davis played a significant role in these fields [8].

The new variety and the harvester were commercially available in 1962. While in 1964 only 3% of the crop was harvested mechanically, this proportion rose to about 25% in 1964 and reached almost 100% by 1970 [10, 15].

Early harvesters reduced labor requirement, which was 5.3 hours per ton for manual harvesting, to 2.9 hours per ton [10]. However, buying a harvester was a big investment. In the traditional Midwestern and Midatlantic states, processing tomatoes were predominantly produced on small fields on family-run farms. With these structures, the mechanical harvester, which could harvest some 100 acres per season, was often not an economical alternative to hand picking. This contributed to the shift in

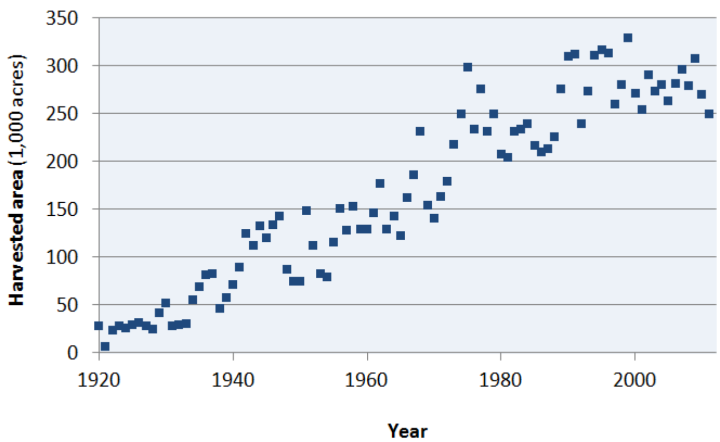

Figure 1: Harvested processing tomato acreage in California from 1920 to 2012 [13].

production from the eastern U.S. to California [5]. In the years following the introduction of the mechanical harvester, California growers continued increasing their share on U.S. processing tomato production. While in 1960 about half of the processing tomatoes produced in the U.S. came from California, this proportion has now reached more than 95% [12].

With increasing yields and further developments of the harvester, such as the electronic sorter and brush shaker, the labor requirements for harvest dropped to 0.4 hour per ton by 1990 [10]. At the same time, the area one machine can harvest increased dramatically from about 100 acres for the early harvesters, to 800 acres by 2000 [5, 10].

Production area

The area planted to processing tomatoes in California has increased almost linearly by more than 3,000 acres per year since the 1920s, reaching some 300,000 acres [13] (Figure 1). California growers not only produce now 95% of the processing tomatoes harvested in the U.S., but also 30% of the global harvest [12, 1]. The only period of decreasing acreage was in the second half of the 1970s when overproduction led to lower prices and economic difficulties for growers. However, a worldwide increase in demand allowed a further increase in the tomato acreage [5].

Figure 2: Location of the five leading processing tomato producing counties in California [14].

The five leading tomato producing counties in 2010 were Fresno, Kings, San Joaquin, and Merced (Figure 2). The production area in these counties accounted for 77% of the processing tomato acreage in California [14].

Fruit yield

In the 1920s, the yield of processing tomatoes averaged some 6 tons/acre in California (Figure 3) [13]. However, Rogers reported in 1916 that occasionally 25 tons were realized [9]. What was an exceptional yield in 1916, was the California average in the early 1980s [12]. Since then, processing tomato yield has further increased; reaching 42 tons/acre on average in the years 2004 to 2007 [12]. In fact, since the 1950s, the fruit yield of tomatoes harvested in California has increased by an average of almost 0.5 ton/acre a year (Figure 3).

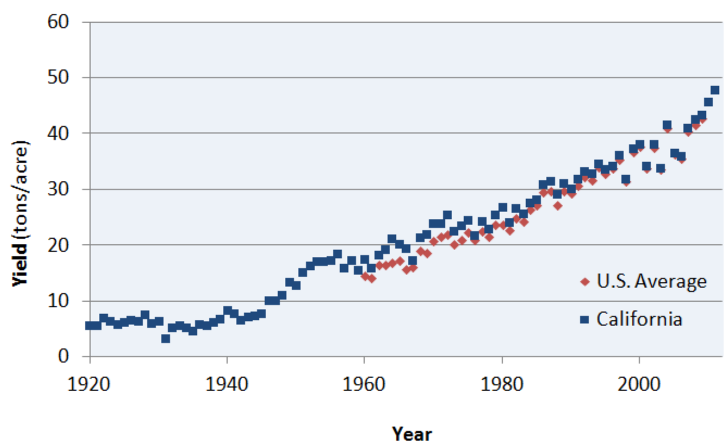

Figure 3: Development of tomato yield since 1920 in California and the U.S. [12, 13].

This dramatic yield increase is the result of a number of factors, most notably the breeding of more productive varieties, the use of mineral fertilizers and pesticides, as well as improved management practices. More recent developments include the use of transplants and drip irrigation. Since 1990, direct seeding has been largely replaced by transplanting. Advantages of transplanting are simplified seedbed preparation, better stand establishment, reduced weed competition and better weed control [4]. The adoption of drip irrigation during the last decade has been impressive. While only 2% of the acreage was under drip irrigation in 2001, this percentage was 19% in 2003, 33% in 2007 and 78% in 2012 [2, 7, 11].

With drip irrigation, yields of 60 tons/acre are not uncommon these days [3]. As more and more growers switch to subsurface drip irrigation and gain experience with the system, further yield increases can be expected.

The decreasing difference in the yield between California and the U.S. average seen in Figure 3 should not be surprising, as California's share of processing tomatoes produced in the U.S. has increased from 50% to over 90% since the 1960's [12].

Not only the production area and yield of tomatoes increased dramatically over the years, while Rogers reported average production costs of $ 32 per acre in 1916, the costs exceeded $ 2,200 in 2007 [6, 9].

Fertilization

Between 1990 and 2010, the annual nitrogen application rates to processing tomatoes averaged 185 lbs/acre [12]. The application rated tended to increase slightly over the years, however, year to year variability was large (Figure 4). The increase in nitrogen fertilizer used by an annual 1.5% relative to the application rate in 1992 mirrors the yield increase realized during the same period.

The potassium application rate since 1990 averaged 54 lbs K_2O/acre, and the phosphorus application rate 100 lbs P_2O_5/acre [12].

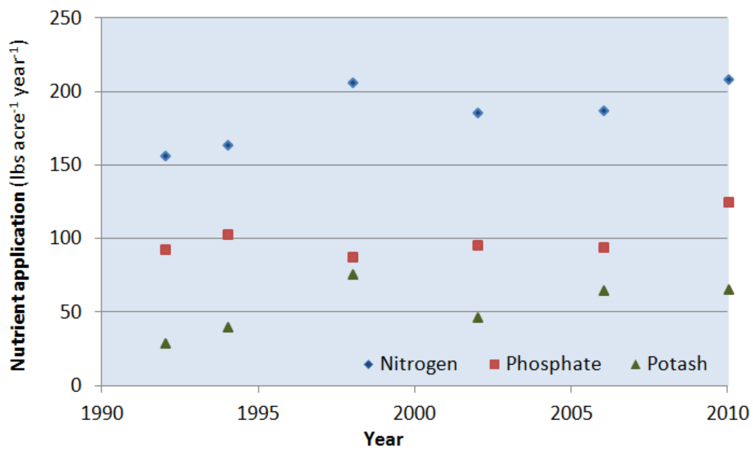

Figure 4: Fertilizer use for processing tomatoes in California [12].

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