

# Safflower Production in California

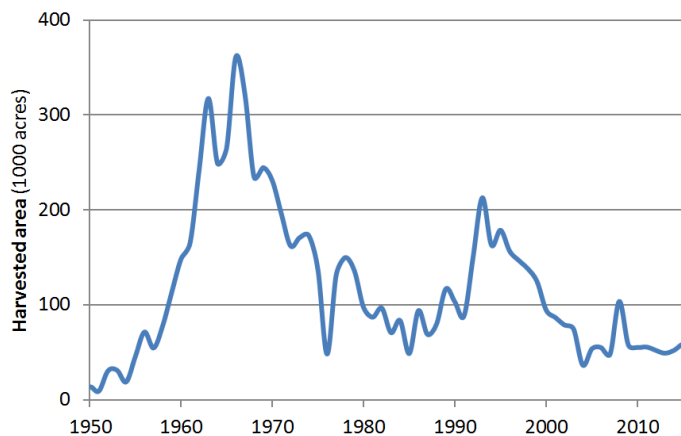
*Patricia Lazicki and Daniel Geisseler*

## Historic Background

Safflower has been grown for thousands of years in Asia and the Middle East, where it was used chiefly as a dye and for medical purposes. The first record of safflower planting in the United States was in a University of California research station report in 1901, although it was probably introduced much earlier by immigrants from Mediterranean areas [2,3]. However, no attempt was made to grow the crop commercially until the 1930s, when its low oil content made it initially unattractive to producers.

Extensive research and breeding efforts in the next few decades succeeded both in raising the oil content and producing safflower varieties with a high ratio of oleic fatty acid to linoleic fatty acid, yielding an oil with similar chemical properties to olive oil [2]. In 1950 several oilseed companies began contracting commercial safflower planting around California, especially in the Imperial and San Joaquin valleys. However, because little was then known about appropriate soils and cultural methods many crops failed [4]. Experimentation conducted by oilseed companies in conjunction with UC farm advisors over the next few years showed that safflower was best adapted to heavy soils on the west and southwest sides of the San Joaquin Valley, the central part of the Sacramento Valley, and in the Delta region if herbicide was used to control weeds [4].

Safflower production increased rapidly in the 1960s, peaking in 1966 at 360,000 acres (Figure 1) [5]. Part of the boom in the 1960s was fueled by a new public perception of the health benefits of polyunsaturated oils. In addition, safflower oil



**Figure 1:** Area of safflower harvested in California since 1950 [4,5,6].

was in demand industrially as a drying oil for high quality paints. Safflower meal, a by-product of the expelling process, was also gaining acceptance as an animal feed [4]. However, growing demand for edible safflower oil combined with competition for land from new high-yielding wheat varieties drove up safflower prices, eliminating most markets for industrial safflower oil by the early 1980s. In addition, during the 1970s the focus of advertising in the US shifted to unsaturated rather than polyunsaturated oils, and health-conscious consumers started to replace safflower oil with less expensive canola oil. In the late 1980s and early 1990s, a growing Japanese market for polyunsaturated salad oil produced another boom [4]. By the early 2000s, however, competition by olive and canola oils was eroding this market [1]. In addition, safflower is a host for the lygus bug, causing growers who also grow cotton or tomatoes to avoid it [7]. However, due to its importance as a rotation crop a small but stable acreage continues to be grown.

## Today's Production

Linoleic and oleic oil types are marketed as separate products. California grows mostly oleic safflower, although linoleic is also grown <sup>[2]</sup>. Today, because of a limited market, safflower is generally only grown on a small acreage as a rotation crop. Safflower is relatively tolerant of saline conditions and can exploit soil water and nutrients to a depth of ten feet or more, making it valuable for improving infiltration and leaching of saline soils, drying down saturated soils, and as a catch crop for leached nitrate <sup>[8]</sup>. It also requires little or no in-season irrigation, making it a good option in drought years. California safflower is commonly grown both under rainfed and irrigated conditions. In the southern San Joaquin Valley, it is mostly irrigated <sup>[5]</sup>. It is normally grown in rotation with small grains, tomatoes, cotton, rice, corn and sugar beets <sup>[2]</sup>.

California is the largest safflower producer in the US, in 2012 accounting for about 40% of national safflower acreage. Montana and Idaho also have significant acreages <sup>[5]</sup>.

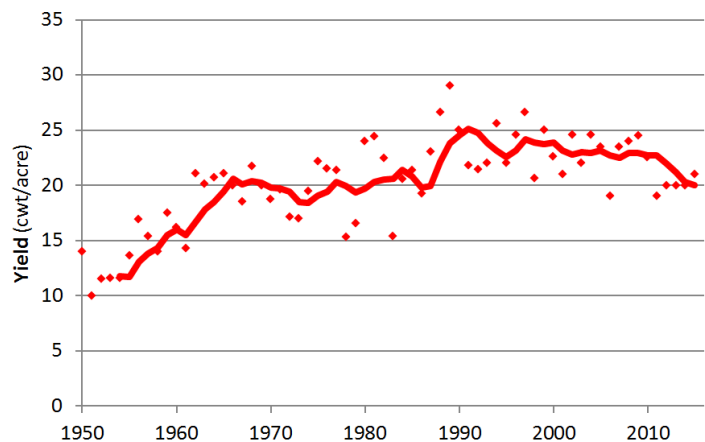


**Figure 2:** Top safflower-producing counties in California according to 2012 census data <sup>[5]</sup>.

In 2012, most California safflower was grown in the Sacramento Valley, with some acreage reported in the San Joaquin Valley and on the Central Coast (Figure 2) <sup>[5]</sup>. Yolo County is the leading producer of safflower in California, with about 40% of the state's reported acreage in 2012. San Joaquin, Sacramento, Solano, Sutter and Contra Costa counties also have important acreage <sup>[5]</sup>.

## Yield

Average safflower seed yield in California nearly doubled between 1950 and 1970, as a coordinated series of research trials identified appropriate soil types and best cultural practices (Figure 3) <sup>[4]</sup>. Yields have remained relatively stable since 1970, averaging between 20-25 cwt/acre <sup>[5]</sup>. However, breeding efforts over the years have resulted in varieties with increased seed oil content, from around 30% in 1950 to over 45% in 1990 <sup>[2]</sup>.



**Figure 3:** Average California safflower seed yields since 1950. Line represents the 5-year average <sup>[4,5,6]</sup>.

## Fertilization

Application rates of 75-175 lbs N/acre for irrigated safflower and 30-60 lbs N/acre for dryland safflower are common <sup>[2]</sup>. Deep injection of aqua ammonia is preferred <sup>[4]</sup>. Split N applications are not normally practiced.

Phosphorus fertilization is also common, especially when safflower is grown after rice. Rates of 40-60 lbs P<sub>2</sub>O<sub>5</sub>/ acre are drilled with or below the seed. Potassium deficiency is rare and K is not normally applied <sup>[2]</sup>.

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## References

1. Independent Chemical Information Service, 2003. Safflower oil market stable, demand outlook promising. 28 November, 2003. Available online at: <http://www.icis.com/resources/news/2003/11/28/538354/safflower-oil-market-stable-demand-outlook-promising/>
2. Kaffka, S.R., Kearney, T.E., 1998. Safflower production in California. University of California Agriculture and Natural Resources Publication 21565.
3. McGuire, P.E., Damania, A.B., Qualset, C.O., (eds.) 2012. Safflower in California: The Paulden F. Knowles personal history of plant exploration and research on evolution, genetics, and breeding. Agronomy Progress Report No. 313, Dept. of Plant Sciences. University of California. Davis CA USA. Available online at: <http://ucanr.edu/sites/plantbreeding/files/151269.pdf>
4. Smith, J., 1996. Safflower. AOCS Press, Champaign, Illinois, USA.
5. USDA NASS. Quickstats. Available online at: <http://quickstats.nass.usda.gov/> (Accessed September, 2016)
6. USDA NASS. County Ag Commissioners' Data Listing. Available online at: [https://www.nass.usda.gov/Statistics\\_by\\_State/California/Publications/AgComm/Detail/](https://www.nass.usda.gov/Statistics_by_State/California/Publications/AgComm/Detail/) (Accessed November, 2016).
7. Western Integrated Pest Management Center, 2016a. Safflower makes an areawide IPM program work. Available online at: <http://westernipm.org/index.cfm/ipm-in-the-west/agriculture/safflower-makes-an-areawide-ipm-program-work/> (Accessed September, 2016).
8. Western Integrated Pest Management Center, 2016b. Safflower & areawide IPM. Posted to Youtube on August 28, 2016. Available online at: <https://www.youtube.com/watch?v=z8VEaJNOAVo> (Accessed September, 2016).

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This document is available online at [https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Safflower\\_Production\\_CA.pdf](https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Safflower_Production_CA.pdf)

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