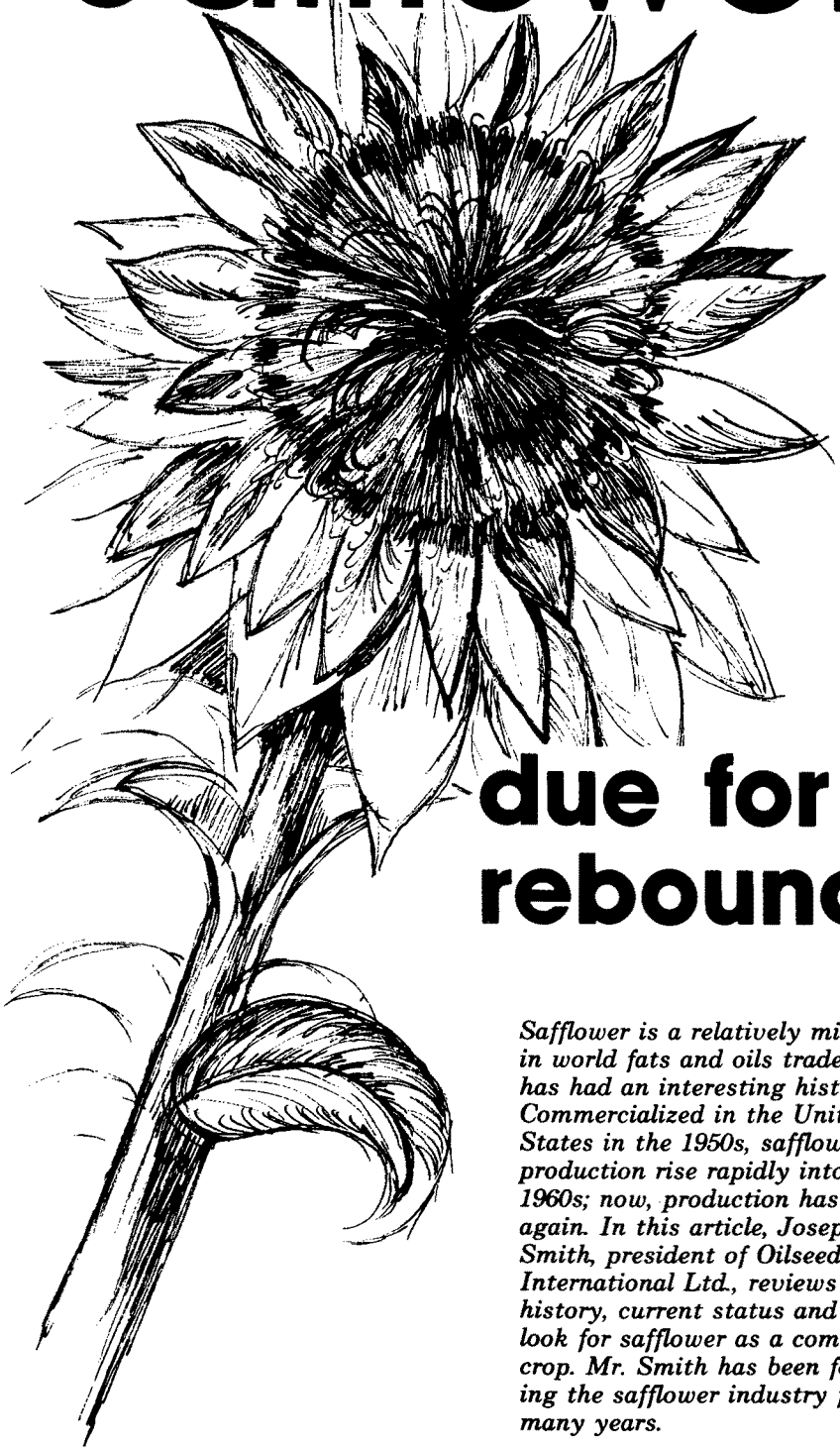
Feature

Safflower: due for a rebound?



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Safflower is a relatively minor oil in world fats and oils trade, but it has had an interesting history. Commercialized in the United States in the 1950s, safflower saw production rise rapidly into the 1960s; now, production has fallen again. In this article, Joseph R. Smith, president of Oilseeds International Ltd., reviews the history, current status and outlook for safflower as a commercial crop. Mr. Smith has been following the safflower industry for many years.

Safflower is a member of the composite family that includes sunflower, artichokes, chrysanthemums and thistles. Commercial safflower closely resembles a traditional Scottish thistle with a yellow or orange flower instead of the Scottish purple.

Safflower is native to most Mediterranean countries, to the Near East, Afganistan, India, Pakistan and China. Other than in India, safflower had never been grown in any quantity prior to World War II. It always was a locally produced and processed plant at best—many thorns and a relatively low oil content didn't encourage commercialization.

Work led by the University of Nebraska Chemurgy Project in the 1930s and 1940s found safflower to be a promising alternate crop. Varieties were produced that increased oil content from the ranges prevalant for the past 2,000 years (20-28%) up to 32-34%, along with reduced shattering of ripe seed. The project developed reasonable cultural practices that would allow the plant to be grown with conventional farm machinery.

Varieties developed in Nebraska were brought to California in 1949 and proved successful as both an irrigated crop and a dry land crop. Safflower began to flourish in Arizon's irrigated valleys, in California's central valleys and, from time to time, in eastern Washington.

Plantings with the same varieties in the western Great Plains from Texas to the Canadian border met with limited success, because of weed problems and alternate drought and moisture related disease problems,

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TABLE I

Trends in U.S. Safflowerseed Production

	Acreage			Production in short tons					
Year	California	Arizona	Other	California	Arizona	Other	Total	Exports	Crush
1946			2,000			500			
1951	17,000		10,000	7,500		2,500	10,000	2,500	7,500
1956	84,000		5,000	71,684		900	72,584	30,200	40,000
1961	210,000	1,300	200,000	134,800	13,664	28,616	177,080	73,000	93,000
1966	341,000	38,000	21,500	299,200	52,200	5,350	356,750	148,800	193,300
1971	222,000	20,000	12,000	217,000	28,000	5,000	250,000	57,995	186,000
1976	67,300	300	13,000	67,650	300	7,800	75,500	7,576	64,000
1981	89,000	1,500	48,000	90,600	1,725	16,500	108,825	11,994	93,000
1982	105,900	4,600	45,000	106,900	5,700	20,000	132,600	23,289	105,000
1983	63,000	3,600	112,800	49,000	3,000	47,000	99,000	28,380	65,000
1984	98,500	6,100	101,500	102,700	6,100	30,000	138,800	53,500	80,600
1985	84,000	—	110,111	91,000	—	30,000	121,000	28,500	88,000

until the introduction of new herbicides and more adapted varieties in the 1960s allowed some production to stabilize in eastern Montana and western North Dakota.

Safflower Markets

The market for safflower oil today is totally different than when the crop was commercialized in the early 1950s. Then, 90% of safflower oil was used by industrial consumers in the preparation of paints, alkyd resins, varnishes and automobile finishes. Safflower oil prices were competitive with those of the two principal oils used in paint. It dried faster than soybean oil and did not yellow with age, as linseed oil did.

Three factors began to change this situation in the mid-1950s: (1) large-scale buying of safflower seed by Japan; (2) the polyunsaturated oil boom, and (3) the introduction of better yielding Mexican wheat varieties into the western United States.

An oversight after World War II, when Japan was adopting import codes, helped create a substantial market for safflowerseed as a source of cooking oil. Nobody in Japan had heard of safflower, so no duty was mentioned. Soybeans were taxed heavily, and tonnage quotas were imposed. For a number of years, safflowerseed enjoyed this advantage over soy until soybean duties and quotas were gradually withdrawn, and Japanese competition for available supplies caused prices of safflowerseed to escalate.

The growth of awareness of the effect of cholesterol on heart disease, and in turn the encouragement toward high polyunsaturate diets to reduce serum cholesterol, created a new market for safflower oil. A number of safflower oil based margarines, salad oils and dressings were introduced, increasing demand dramatically. At the same time, paint technology was changing and oil-based formulations were changing to water-based latex, PVC or acrylic formulations requiring little or no vegetable oil.

The introduction of higher yielding Mexican wheats in California and Arizona also put upward pressure on safflowerseed prices. Previously, safflower had to compete with barley or older wheat varieties yielding 1½ tons per acre; the new wheat varieties increased wheat yields to 2½ to 3 tons per acre, meaning that growers required higher prices for safflower to compete on a given acreage.

As safflowerseed and oil prices climbed, demand in the paint industry fell. Japanese consumption declined as soy became more competitive, and some U.S. safflower brands abandoned the market. Today, 90% of safflower oil in the U.S. and Europe is consumed in premium-priced food products aimed at the heart-conscious diet trade. In Japan, demand for safflower oil as ordinary cooking oil has vanished, and safflower oil consumption is confined to the health conscious gift market where high priced, beautifully packaged food products are purchased during the summer and Christmas gift giving seasons.

Table I illustrates the trends in safflowerseed production in the U.S. since the crop was introduced, and compares the amount crushed in the U.S. versus seed exports.

Table II illustrates the relationship between safflowerseed and oil, and the price of soybean oil and wheat.

In the final analysis, most safflower oil being used today is purchased because it has the highest level of polyunsaturates available, and those who demand its particular fatty acid structure are willing to pay, if necessary, a substantial premium over other

TABLE II

Safflowerseed/Oil, Winter Wheat and Soybean Oil Prices

Year	Average price Calif. saff. seed $/ST	Average price, c/lb. NB saff. oil 1950-69 FOB NY 1969 on: FOB WC mills	Average price hard red winter wheat KC cash price $/bu.	Soybean oil FOB Decatur c/lb.
1951	$ 97.28	16.00	2.43	11.30
1956	$ 76.00	16.10	2.21	12.70
1961	$ 86.00	17.20	2.05	9.50
1966	$ 98.00	15.50	1.85	10.10
1971	$104.00	15.00	1.60	12.80
1976	$243.00	45.00	2.88	18.80
1981	$360.00	46.00	4.27	21.00
1982	$298.00	40.00	3.94	18.40
1983	$250.00	38.00	–	30.50
1984	$275.00	42.00	–	30.70
1985	$250.00	–	–	

oils to get it.

Oleic safflower oil (a mutation discovered by the University of California at Davis) produces an oil in which the normal rate of 77% linoleic/15% oleic fatty acids is reversed. It consequently produces an oil much more stable than normal safflower oil, that is monounsaturated instead of polyunsaturated, and grows from plants and seeds produced at the same cost as normal safflower oil. Approximately 20% of the safflower produced today in the U.S. is of the oleic type, and markets for it are growing. It is used primarily in the production of baby formulas, for special snack frying and in blends with other oils.

Production

Table I also illustrates some of the changes that have occurred in safflower production during the past 35 years. During the 1960s, when production was at a peak, more than 16 companies and eight oil mills were engaged in buying and processing U.S. safflowerseed. Today, only seven buyers and four oil mills remain. Three companies are engaged in safflower plant breeding, and four state and federal agencies are doing limited amounts of work with the crop.

Almost all safflower is produced under contract to buyers who guarantee a firm price at planting time in return for the grower's committing his entire production. This scheme tends to keep supply in balance with demand.

Research has brought safflower yields to an average of one short ton per acre or better in California; many farmers achieve more than 3,000 pounds per acre. Oil contents of present day varieties have been raised to the 43% level.

For many years, production in Montana and North Dakota was limited by safflower's inability to compete with weeds. Improved cultural practices and, more importantly, the release of preemergence herbicides, helped to conquer that problem. Montana safflower also suffered from lower yields (700 pounds per acre) and lower oil contents (34-37%) than California/Arizona production, but recently, introduction of California seed types allowed plains safflower to exceed 40% oil content, and to improve yield potential. It's not clear yet whether these types will deliver this oil level and improved yield in years with higher rainfall than seen recently. Safflower tends to develop head rot diseases in years with high summer rainfall. California and Arizona have essentially no rain between June and October, when safflower matures. Plains states normally have some rain each summer month.

A Japanese desire to import seed rather than oil also favored production of higher oil content seed from California and Arizona as opposed to lower oil content from Montana seed which was much farther from export elevators. In Japan, however, one of the main marketers of safflower oil decided several years ago to import oil rather than seed. It now appears possible that other Japanese mills will follow suit.

Prices offered growers in Montana/North Dakota, $200 per short ton for the 1984 and 1985 crops, are considerably cheaper than the $250-$275 paid in California.

All of these recent factors have led to increased plantings in the Plains states, reductions in California and a drop to zero in Arizona for 1985.

Processing

All of the mills currently processing safflower use the prepress/solvent extraction method to extract oil from the safflowerseed. In safflower's early days in the U.S., most mills handling it used the expeller (continuous screw press)

method—and all quickly became better acquainted with their fire insurance carriers. Expeller processed safflower meal (with a residual fat content of 5 to 9%) seems almost explosive in nature. Early safflowerseed suffered many times from weedy conditions and, when not properly cleaned or dried, it tended to cause storage fires. Practically every safflower mill had a major fire.

Handlers of safflowerseed now know the seed can be stored safely so long as it is kept below 8% moisture and kept free of green weed seeds. Prepressing removes 60% of available oil in a mechanically extracted form for those consumers desiring such material, and the subsequent hexane extraction reduces residual oil content to 1-1.5% which removes all fire danger.

Low free fatty acid California oil (0.15-0.3%) can be deodorized directly without caustic refining to salad grade. It also meets the non-break specification for those remaining paint consumers.

Solvent extracted safflower oil, or a blend of prepress-expeller and solvent extracted oil, can be easily refined, bleached and deodorized in conventional equipment.

Unlike sunflower, safflower's fatty acid is only mildly affected by temperatures at flowering time, so that seed from Arizona or Montana varies only 2 to 3% in linoleic percentage. Chinese safflower oil exceeds 81-82%, whereas at times, Spanish or Australian safflower oil may be below 74%. Similarly, the oleic type of safflower varies only between 76 to 80% oleic, depending on the year and area of production.

Future

Thirty-five years ago, when safflower was introduced in the U.S., it was a new crop with much promise. Some predicted that it would reach a million acres of production. This didn't happen, and production in 1985 is at a low ebb; the crop may be at a crossroad between oblivion and re-expansion.

On the positive side, we find:

- Hybrid safflowerseed offering 15-25% yield improvement may be three to five years away. Even 25% improvement in yield will not greatly increase markets for normal safflower oil, because the premium over soybean or corn oil is on the order of 60%. This premium must be overcome to allow safflower to gain large new markets from other oils.
- Demand for normal safflower oil appears to be growing slowly—a continuing world interest in more healthy foods ensures that the present market for safflower won't shrink unless prices go crazy. Production is not likely to grow in Australia, Argentina or Spain, where sunflower is more important. Mexico can't supply its own needs, and Japan appears not happy with the low oil content of Chinese safflower—this is not likely to change quickly. So, the U.S. is the most likely source of any added needs. Demand for oleic safflower may grow faster. Although hybrid oleic sunflower can be grown over a much wider range of climates and should be able to be produced more cheaply and offer higher oleic content levels, demand for oleic sunflower oil in the chemical derivative business may keep its price elevated and allow oleic safflower oil to capitalize on what looks like a growing demand for high monounsaturated food oils: the so-called Mediterranean Diet that lowers LDL cholesterol, but leaves the HDL alone, unlike polyunsaturated oils, which reduce both. (See page 194, *Journal of Lipid Research,* Volume 26, 1985, for a detailed study of this matter.)
- Expansion of safflower production into broad areas of the Great Plains, if successful, could produce greater volumes of safflower oil at lower prices compared to levels attainable in Arizona and California. Yield potential of safflower in central North Dakota is markedly higher than in the traditional northwest corner of North Dakota/northeast corner of Montana, but disease and frost damage possibilities increase as well. If the newer varieties do a better job of resisting disease problems and contribute more oil per ton, this expansion will come true.
- Safflower prices can remain relatively low if grain prices also remain low and yields for grain remain stagnant.

On the other side of the coin:

- Prices for safflower meal also are low (putting upward pressure on safflower oil prices), and the protein picture isn't likely to improve quickly.
- The general world oil price outlook, with floods of new palm oil on the horizon, is downward. This will only widen the premium between safflower and other oils, and over time big price differences tend to defeat other reasons for buying the higher priced material.

On balance, we would expect safflower production to climb slightly in California (because it is a dependable source of supply, compared to Great Plains production) and Great Plains production to expand sharply for a year or two. (Sunflower farmers unhappy with falling prices and increased insect and bird control costs may switch to safflower.) This increase could drive seed prices down sharply and eventually bring production of regular safflower back to the equilibrium achieved in 1984/85. Oleic safflower production will probably increase 30% with most of that concentrated in California. If the HDL/LDL hypothesis gains more credence, oleic safflower production could rise sharply.