

SAFFLOWER: UTILIZATION AND SIGNIFICANCE IN NUTRITION AND ALLERGY

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THE safflower plant, *Carthamus tinctorius L.*, is an annual of the composite family and produces valuable oil seeds. Historically, it is one of the oldest oil seed plants known.

Safflower has been cultivated since ancient times in Northern Africa, the Middle East, and the Orient. The antiquity of safflower is recorded in the colors of the linen wrapping cloths of the mummies of Egypt.¹ Although oil from safflower seed was used to light the lamps and the meal to fatten the cattle of ancient races, carthamin, the coloring matter of the flowers, remained the main product of the crop until the end of the last century, when the synthetic aniline dyes replaced it.² Carthamin, by suitable treatment, produces a variety of red colors, the most common ranging from rose-red to cherry-red. Its main commercial value was to color cloth and its use in India for this purpose has persisted in the presence of other dyes because it is traditionally used in the coloring of wedding garments.¹

In the United States, safflower was introduced experimentally as an oil crop in 1925. It is adapted to parts of the northern Great Plains, the area between the Cascades and Rocky Mountains, the interior valleys of California, and irrigated sections of Arizona.

The safflower plant has composite flower heads with green bracts (Fig. 1). The most common varieties have yellow or orange flowers. Each plant usually produces 1 to 5 flower heads; each head develops 15 to 50 seeds (Fig. 2). Most safflower is spring planted and matures in 110 to 150 days. The seed contains 32 to 40 per cent oil, 11 to 17 per cent protein, and 4 to 7 per cent moisture. The hull accounts for from $\frac{1}{3}$ to $\frac{1}{2}$ the total weight of the seed. Safflower usually will not grow as a weed. Competing wild plants overshadow it before it becomes established.³

The initial economic impetus since 1950 for the cultivation of safflower in the United States was primarily for its use as a paint oil. In recent years there has been an increasing demand for the edible oil, composed principally of polyunsaturated triglycerides, which allegedly has unique hypocholesterolemic nutritional value according to current theories linking the type and amount of dietary fat with serum cholesterol levels and coronary heart disease. It has been shown that vegetable fats have a lipid-lowering effect.⁴ When patients

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Fig. 1.—Safflower plant, *Carthamus tinctorius* L., an annual of the composite family. Note the composite flower head before opening, head in flower, and spiny bracts.

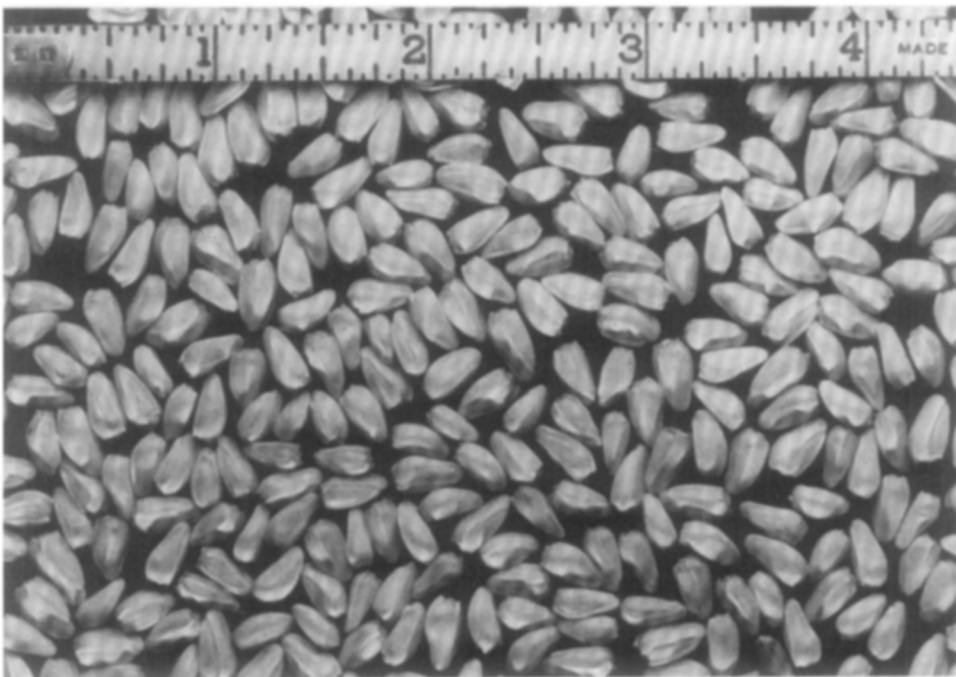


Fig. 2.—Safflower seed contains up to 40 per cent oil and 17 per cent protein. The hull accounts for $\frac{1}{3}$ to $\frac{1}{2}$ of the total weight of the seed.

were fed corn oil, the serum cholesterol level was reduced. The most readily available and economic forms of unsaturated fats are corn oil and safflower oil. The latter has the highest available polyunsaturated-saturated ratio of 9 to 1 and highest linoleic acid content of 75.4 per cent.

The allergist's increasing interest in safflower, aside from its nutritional import, lies in the fact that the safflower plant, as a member of the composite family, is related to ragweed, the most important allergenic plant in the United States. This is not to imply that there is any known cross-reactivity between the members of the composite family and safflower seed, meal, or oil. Industrial experience among workers processing safflower seed, meal, and oil has been conspicuous by the absence of any allergic problems in contrast with the case of those who process castor bean.⁵ Nevertheless, it behooves the allergist to have some general background information of another seed product which is becoming widely distributed among the population. The principal food products made from safflower oil are salad oil, salad dressing, mayonnaise, and margarine, and it is principally used in frying, baking, cooking, imitation ice cream, and filled dairy products. Safflower, because it has very little linolenic acid, has excellent color retention properties and no after-yellowing. This unique property of safflower oil makes it particularly adapted to the production of alkyd resins, which have steadily replaced oil in hard resin varnishes, paints, and enamels. They dry faster than those made from other vegetable oils.

When oil is crushed from safflower seed, that which remains is generally known as safflower meal or seed cake. It is used as a protein feed supplement for cattle, sheep, and poultry. The whole seed of safflower has been an important food for parrots and poultry. The spineless form of safflower in the young stage is edible and has been used as a vegetable in India and Burma. Fresh safflower hay, before blossoming, is readily eaten by sheep in spite of the spines. Safflower has been made into a silage by adding fermenting agents and has been used successfully in hog rations. After harvest, safflower fields have been grazed by livestock.

The dried leaves of the safflower have been ground to powder and used to coagulate milk. Carthamin, the coloring matter of the flowers, is used to color cosmetics, food, confections, artificial flowers, and liqueurs. Safflower honey, produced from the safflower blossom, has recently appeared on the market. Since there is always a certain amount of pollen in all honey that is not filtered, there is a possibility of safflower pollen being ingested.

It is well known that seeds of certain plants (i.e., cottonseed, soya bean, peanut, and corn) from which edible oils are obtained contain allergens which are extremely potent. Despite the marked allergenicity of the water-soluble protein fraction of the seed hull, the distinction must be made between sensitivity to the meal and sensitivity to the edible vegetable oil. This problem should have been resolved by the outstanding investigative work by Spies, Bernton, and Stevens,^{6,7} by Figley,⁸ and Layton and associates,⁹ but there are others¹⁰ who still claim that cottonseed oil is allergenic.

Vegetable oils are obtained either by applying pressure to oil-bearing seed (expeller method), by extracting with solvent, or by a combination of both

(prepressed solvent extraction method). Crude vegetable oils undergo at least 3 purification treatments: (a) alkali refining, (b) filtration, and (c) steam deodorization.

During alkali refining, the oil is mixed with an aqueous solution of sodium hydroxide (9.5 to 14 per cent) which reacts with any free fatty acids to form a soap. This treatment also serves to coagulate lecithin-like material and other impurities in the oil. Protein has never been identified as a component of an alkali-refined vegetable oil.¹¹ Most of the refined vegetable oils are subjected to "bleaching" by being mixed with clay and carbon, which not only decolorizes the oil by adsorption but also filters it to remove any sediment left from previous settling or centrifuging. Finally, the oil is subjected to steam deodorization. This is a vacuum steam distillation to remove the volatile products which contribute to an undesirable flavor. The oil is maintained at a temperature range from 425 to 460° F. under a 1/2 inch mercury pressure for 3 to 4 hours, during which time steam is blown through the oil at the rate of 0.03 pound per pound of oil per hour. The temperatures thus used in deodorization are sufficient to denature almost any protein material.¹¹ It is inconceivable for any protein allergen to retain its activity after such treatment.

Vegetable oils refined in the above manner are nonallergenic. Patients who are clinically sensitive only to the water-soluble seed extractants may safely ingest the refined oil.⁸

Serious constitutional reactions and deaths^{12, 13} have been reported from intradermal testing with water-soluble seed extracts. It would be prudent, therefore, to limit skin testing with the water-soluble fraction of the safflower seed antigen to scratch or puncture testing only.

SUMMARY

The safflower plant is an annual of the composite family. Its seed produces a valuable edible oil with the highest available polyunsaturated-saturated ratio and linoleic acid content. Aside from its increasing importance in human nutrition, the oil is used in alkyd resins, paints, and enamels. Safflower meal is used as a protein feed supplement for cattle, sheep, and poultry. Honey is produced from the safflower blossom.

Safflower oil is nonallergenic. Testing with the water-soluble protein fraction of the seed should be performed first by the scratch or puncture method.

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