

Saffron

For other uses, see Saffron (disambiguation).

Saffron (pronounced /ˈsæfrən/ or /ˈsæfrɒn/)^[1] is a spice



Saffron – valuable stigmas, or threads, are painstakingly plucked, piled, and dried.

derived from the flower of *Crocus sativus*, commonly known as the **saffron crocus**. *Crocus* is a genus in the family Iridaceae. Saffron crocus grows to 20–30 cm (8–12 in) and bears up to four flowers, each with three vivid crimson stigmas, which are the distal end of a carpel.^[2] Together with the styles, or stalks that connect the stigmas to their host plant, the dried stigmas are used mainly in various cuisines as a seasoning and colouring agent. Saffron, long among the world’s most costly spices by weight,^{[3][4][5]} is native to Greece or Southwest Asia^{[6][4]} and was first cultivated in Greece.^[7] As a genetically monomorphic clone,^[8] it was slowly propagated throughout much of Eurasia and was later brought to parts of North Africa, North America, and Oceania.

The saffron crocus, unknown in the wild, probably descends from *Crocus cartwrightianus*, which originated in Crete;^[8] *C. thomasii* and *C. pallasii* are other possible precursors.^{[9][10]} The saffron crocus is a triploid that is “self-incompatible” and male sterile; it undergoes aberrant meiosis and is hence incapable of independent sexual reproduction—all propagation is by vegetative multiplication via manual “divide-and-set” of a starter clone or by interspecific hybridisation.^{[11][10]} If *C. sativus* is a mutant form of *C. cartwrightianus*, then it may have emerged via plant breeding, which would have selected for elongated stigmas, in late Bronze Age Crete.^[12]

Saffron’s taste and iodoform- or hay-like fragrance result from the chemicals picrocrocin and safranal.^{[13][14]} It also contains a carotenoid dye, crocin, which imparts a rich golden-yellow hue to dishes and textiles. Its recorded

history is attested in a 7th-century BC Assyrian botanical treatise compiled under Ashurbanipal,^[15] and it has been traded and used for over four millennia. Iran now accounts for approximately 90% of the world production of saffron.^[16]

1 Etymology

Further information: History of saffron

A degree of uncertainty surrounds the origin of the English word, "saffron" although it can be traced to have stemmed immediately from 12th-century Old French term *safran*, which comes from the Latin word *safranum*. *Safranum* comes from the Persian intercessor زعفران, or *za'ferân*. Old Persian is the first language in which the use of saffron in cooking is recorded, with references dating back thousands of years. In fact some sources argue that it originated from Middle East/Persia and became associated with Greek, Spanish, and Indian cuisines.^[17]

2 Species

Main article: *Crocus sativus*

2.1 Description

The domesticated saffron crocus, *Crocus sativus*, is an autumn-flowering perennial plant unknown in the wild. Its progenitors are possibly the eastern Mediterranean autumn-flowering *Crocus cartwrightianus*,^{[18][10]} which is also known as “wild saffron”^[19] and originated in Greece.^[14] The saffron crocus probably resulted when *C. cartwrightianus* was subjected to extensive artificial selection by growers seeking longer stigmas. *C. thomasii* and *C. pallasii* are other possible sources.^{[9][10]}

It is a sterile triploid form, which means that three homologous sets of chromosomes compose each specimen’s genetic complement; *C. sativus* bears eight chromosomal bodies per set, making for 24 in total.^[2] Being sterile, the purple flowers of *C. sativus* fail to produce viable seeds; reproduction hinges on human assistance: clusters of corms, underground, bulb-like, starch-storing organs, must be dug up, divided, and replanted. A corm survives for one season, producing via this vegetative division up



Köhler's Medicinal Plants:

to ten “cormlets” that can grow into new plants in the next season.^[18] The compact corms are small, brown globules that can measure as large as 5 cm (2.0 in) in diameter, have a flat base, and are shrouded in a dense mat of parallel fibres; this coat is referred to as the “corm tunic”. Corms also bear vertical fibres, thin and net-like, that grow up to 5 cm above the plant’s neck.^[2]

*C. sativus*.

The plant grows to a height of 20–30 cm (8–12 in), and sprouts 5–11 white and non-photosynthetic leaves known as cataphylls. These membrane-like structures cover and protect the crocus’s 5 to 11 true leaves as they bud and develop. The latter are thin, straight, and blade-like green foliage leaves, which are 1–3 mm in diameter, either expand after the flowers have opened (“hysteranthous”) or do so simultaneously with their blooming (“synanthous”).

C. sativus cataphylls are suspected by some to manifest prior to blooming when the plant is irrigated relatively early in the growing season. Its floral axes, or flower-bearing structures, bear bracteoles, or specialised leaves that sprout from the flower stems; the latter are known as pedicels.^[2] After aestivating in spring, the plant sends up its true leaves, each up to 40 cm (16 in) in length. In autumn, purple buds appear. Only in October, after most other flowering plants have released their seeds, do its brilliantly hued flowers develop; they range from a light pastel shade of lilac to a darker and more striated mauve.^[20] The flowers possess a sweet, honey-like fragrance. Upon flowering, plants average less than 30 cm (12 in) in height.^[21] A three-pronged style emerges from each flower. Each prong terminates with a vivid crimson stigma 25–30 mm (0.98–1.18 in) in length.^[18]

2.2 Cultivation



Saffron bulbs for vegetative reproduction

Crocus sativus thrives in the Mediterranean maquis, an ecotype superficially resembling the North American chaparral, and similar climates where hot and dry summer breezes sweep semi-arid lands. It can nonetheless survive cold winters, tolerating frosts as low as -10°C (14°F) and short periods of snow cover.^{[18][22]} Irrigation is required if grown outside of moist environments such as Kashmir, where annual rainfall averages 1,000–1,500 mm (39–59 in); saffron-growing regions in Greece (500 mm or 20 in annually) and Spain (400 mm or 16 in) are far drier than the main cultivating Iranian regions.

What makes this possible is the timing of the local wet seasons; generous spring rains and drier summers are optimal. Rain immediately preceding flowering boosts saffron yields; rainy or cold weather during flowering promotes disease and reduces yields. Persistently damp and hot conditions harm the crops,^[23] and rabbits, rats, and birds cause damage by digging up corms. Nematodes, leaf rusts, and corm rot pose other threats. Yet *Bacillus subtilis* inoculation may provide some benefit to growers by speeding corm growth and increasing stigma biomass yield.^[24]



Saffron harvesting, Torbat-e Heydarieh, Iran

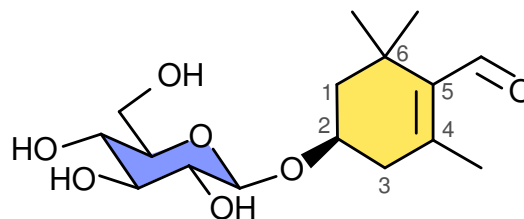
The plants fare poorly in shady conditions; they grow best in full sunlight. Fields that slope towards the sunlight are optimal (i.e., south-sloping in the Northern Hemisphere). Planting is mostly done in June in the Northern Hemisphere, where corms are lodged 7–15 cm (2.8–5.9 in) deep; its roots, stems, and leaves can develop between October and February.^[2] Planting depth and corm spacing, in concert with climate, are critical factors in determining yields. Mother corms planted deeper yield higher-quality saffron, though form fewer flower buds and daughter corms. Italian growers optimise thread yield by planting 15 cm (5.9 in) deep and in rows 2–3 cm (0.79–1.18 in) apart; depths of 8–10 cm (3.1–3.9 in) optimise flower and corm production. Greek, Moroccan, and Spanish growers employ distinct depths and spacings that suit their locales.

C. sativus prefers friable, loose, low-density, well-watered, and well-drained clay-calcareous soils with high organic content. Traditional raised beds promote good drainage. Soil organic content was historically boosted via application of some 20–30 tonnes of manure per hectare. Afterwards, and with no further manure application, corms were planted.^[25] After a period of dormancy through the summer, the corms send up their narrow leaves and begin to bud in early autumn. Only in mid-autumn do they flower. Harvests are by necessity a speedy affair: after blossoming at dawn, flowers quickly wilt as the day passes.^[26] All plants bloom within a window of one or two weeks.^[27] Roughly 150 flowers together yield but 1 g (0.035 oz) of dry saffron threads; to produce 12 g (0.42 oz) of dried saffron (or 72 g (2.5 oz) moist and

freshly harvested), 1 kg (2.2 lb) of flowers are needed; 1 lb (0.45 kg) yields 0.2 oz (5.7 g) of dried saffron. One freshly picked flower yields an average 30 mg (0.0011 oz) of fresh saffron or 7 mg (0.00025 oz) dried.^[25]

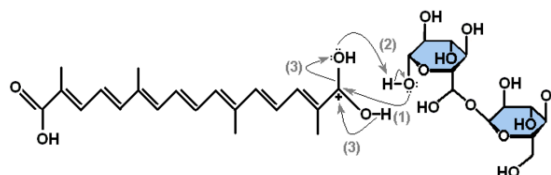
3 Spice

3.1 Chemistry



Structure of picrocrocin.^[28]

Saffron contains more than 150 volatile and aroma-yielding compounds. It also has many nonvolatile active components,^[29] many of which are carotenoids, including zeaxanthin, lycopene, and various α - and β -carotenes. However, saffron's golden yellow-orange colour is primarily the result of α -crocin. This crocin is trans-crocetin di-(β -D-gentiobiosyl) ester; it bears the systematic (IUPAC) name 8,8-diapo-8,8-carotenoic acid. This means that the crocin underlying saffron's aroma is a digentiobiose ester of the carotenoid crocetin.^[29] Crocins themselves are a series of hydrophilic carotenoids that are either monoglycosyl or diglycosyl polyene esters of crocetin.^[29] Crocetin is a conjugated polyene dicarboxylic acid that is hydrophobic, and thus oil-soluble. When crocetin is esterified with two water-soluble gentiobioses, which are sugars, a product results that is itself water-soluble. The resultant α -crocin is a carotenoid pigment that may comprise more than 10% of dry saffron's mass. The two esterified gentiobioses make α -crocin ideal for colouring water-based and non-fatty foods such as rice dishes.^[7]



Esterification reaction between crocetin and gentiobiose. Components of α -crocin:

The bitter glucoside picrocrocin is responsible for saffron's flavour. Picrocrocin (chemical formula: C₁₆H₂₆O₇; systematic name: 4-(β -D-glucopyranosyloxy)-2,6,6-trimethylcyclohex-1-ene-1-carboxaldehyde) is a union

of an aldehyde sub-element known as safranal (systematic name: 2,6,6-trimethylcyclohexa-1,3-diene-1-carboxaldehyde) and a carbohydrate. It has insecticidal and pesticidal properties, and may comprise up to 4% of dry saffron. Picrocrocin is a truncated version of the carotenoid zeaxanthin that is produced via oxidative cleavage, and is the glycoside of the terpene aldehyde safranal. The reddish-coloured zeaxanthin is, incidentally, one of the carotenoids naturally present within the retina of the human eye.^[30]

When saffron is dried after its harvest, the heat, combined with enzymatic action, splits picrocrocin to yield D-glucose and a free safranal molecule.^[28] Safranal, a volatile oil, gives saffron much of its distinctive aroma.^{[13][31]} Safranal is less bitter than picrocrocin and may comprise up to 70% of dry saffron's volatile fraction in some samples.^[30] A second element underlying saffron's aroma is 2-hydroxy-4,4,6-trimethyl-2,5-cyclohexadien-1-one, which produces a scent described as saffron, dried hay-like.^[32] Chemists find this is the most powerful contributor to saffron's fragrance, despite its presence in a lesser quantity than safranal.^[32] Dry saffron is highly sensitive to fluctuating pH levels, and rapidly breaks down chemically in the presence of light and oxidising agents. It must, therefore, be stored away in air-tight containers to minimise contact with atmospheric oxygen. Saffron is somewhat more resistant to heat.

3.2 Grades and ISO 3632 categories



Red threads and yellow styles.

Saffron is not all of the same quality and strength. Strength is related to several factors including the amount of style picked along with the red stigma. Age of the saffron is also a factor. More style included means the saffron is less strong gram for gram, because the colour and flavour are concentrated in the red stigmas. Saffron from Iran, Spain and Kashmir is classified into various

grades according to the relative amounts of red stigma and yellow styles it contains. Grades of Iranian saffron are: "sargol" (red stigma tips only, strongest grade), "pushal" or "pushali" (red stigmas plus some yellow style, lower strength), "bunch" saffron (red stigmas plus large amount of yellow style, presented in a tiny bundle like a miniature sheaf) and "konge" (yellow style only, claimed to have aroma but with very little, if any, colouring potential). Grades of Spanish saffron are "coupe" (the strongest grade, like Iranian sargol), "mancha" (like Iranian pushal), and in order of further decreasing strength "rio", "standard" and "sierra" saffron. The word "mancha" in the Spanish classification can have two meanings: a general grade of saffron or a very high quality Spanish-grown saffron from a specific geographical origin. Real Spanish-grown La Mancha saffron has PDO protected status and this is displayed on the product packaging. Spanish growers fought hard for Protected Status because they felt that imports of Iranian saffron re-packaged in Spain and sold as "Spanish Mancha saffron" were undermining the genuine La Mancha brand.

Countries producing less saffron do not have specialised words for different grades and may only produce one grade. Artisan producers in Europe and New Zealand have offset their higher labour charges for saffron harvesting by targeting quality, only offering extremely high grade saffron.

In addition to descriptions based on how the saffron is picked, saffron may be categorised under the international standard ISO 3632 after laboratory measurement of crocin (responsible for saffron's colour), picrocrocin (taste), and safranal (fragrance or aroma) content.^[33] However, often there is no clear grading information on the product packaging and little of the saffron readily available in UK is labelled with ISO category. This lack of information makes it hard for customers to make informed choices when comparing prices and buying saffron.

Under ISO 3632, determination of non-stigma content ("floral waste content") and other extraneous matter such as inorganic material ("ash") are also key. Grading standards are set by the International Organization for Standardization, a federation of national standards bodies. ISO 3632 deals exclusively with saffron and establishes three categories: III (poorest quality), II, and I (finest quality). Formerly there was also category IV, which was below category III. Samples are assigned categories by gauging the spice's crocin and picrocrocin content, revealed by measurements of specific spectrophotometric absorbance. Safranal is treated slightly differently and rather than there being threshold levels for each category, samples must give a reading of 20-50 for all categories.

These data are measured through spectrophotometry reports at certified testing laboratories worldwide. Higher absorbances imply greater levels of crocin, picrocrocin and safranal, and thus a greater colouring potential and

therefore strength per gram. The absorbance reading of crocin is known as the “colouring strength” of that saffron. Saffron’s colouring strength can range from lower than 80 (for all category IV saffron) up to 200 or greater (for category I). The world’s finest samples (the selected, most red-maroon, tips of stigmas picked from the finest flowers) receive colouring strengths in excess of 250, making such saffron over three times more powerful than category IV saffron. Market prices for saffron types follow directly from these ISO categories. Sargol and coupé saffron would typically fall into ISO 3632 category I. Pushal and mancha would probably be assigned to category II. On many saffron packaging labels, neither the ISO 3632 category nor the colouring strength (the measurement of crocin content) is displayed.

However, many growers, traders, and consumers reject such lab test numbers. Some people prefer a more holistic method of sampling batches of threads for taste, aroma, pliability, and other traits in a fashion similar to that practised by experienced wine tasters.^[34] However, ISO 3632 grade and colouring strength information allow consumers to make instant comparisons between the quality of different saffron brands, without needing to purchase and sample the saffron. In particular, consumers can work out value for money based on price per unit of colouring strength rather than price per gram, given the wide possible range of colouring strengths that different kinds of saffron can have.

Despite attempts at quality control and standardisation, an extensive history of saffron adulteration, particularly among the cheapest grades, continues into modern times. Adulteration was first documented in Europe’s Middle Ages, when those found selling adulterated saffron were executed under the *Safranschou* code.^[35] Typical methods include mixing in extraneous substances like beets, pomegranate fibres, red-dyed silk fibres, or the saffron crocus’s tasteless and odourless yellow stamens. Other methods included dousing saffron fibres with viscid substances like honey or vegetable oil to increase their weight. However, powdered saffron is more prone to adulteration, with turmeric, paprika, and other powders used as diluting fillers. Adulteration can also consist of selling mislabelled mixes of different saffron grades. Thus, in India, high-grade Kashmiri saffron is often sold and mixed with cheaper Iranian imports; these mixes are then marketed as pure Kashmiri saffron, a development that has cost Kashmiri growers much of their income.^{[36][37]}

3.3 Types

The various saffron crocus cultivars give rise to thread types that are often regionally distributed and characteristically distinct. Varieties (not varieties in the botanical sense) from Spain, including the tradenames “Spanish Superior” and “Creme”, are generally mellower in colour, flavour, and aroma; they are graded by government-



Saffron from different producer countries, picked and dried in different ways gives rise to different end qualities.

imposed standards. Italian varieties are slightly more potent than Spanish. The most intense varieties tend to be Iranian. Various “boutique” crops are available from New Zealand, France, Switzerland, England, the United States, and other countries—some of them organically grown. In the U.S., Pennsylvania Dutch saffron—known for its “earthy” notes—is marketed in small quantities.^{[38][39]}

Consumers may regard certain cultivars as “premium” quality. The “Aquila” saffron, or *zafferano dell’Aquila*, is defined by high safranal and crocin content, distinctive thread shape, unusually pungent aroma, and intense colour; it is grown exclusively on eight hectares in the Navelli Valley of Italy’s Abruzzo region, near L’Aquila. It was first introduced to Italy by a Dominican monk from Inquisition-era Spain. But the biggest saffron cultivation in Italy is in San Gavino Monreale, Sardinia, where it is grown on 40 hectares, representing 60% of Italian production; it too has unusually high crocin, picrocrocin, and safranal content. Another is the “Mon-gra” or “Lacha” saffron of Kashmir (*Crocus sativus* ‘Cashmirianus’), which is among the most difficult for consumers to obtain. Repeated droughts, blights, and crop failures in the Indian-controlled areas of Kashmir combine with an Indian export ban to contribute to its prohibitive overseas prices. Kashmiri saffron is recognisable by its dark maroon-purple hue; it is among the world’s darkest, which hints at strong flavour, aroma, and colouring effect.

4 History

Main article: History of saffron

The documented history of saffron cultivation spans



A detail from the "Saffron Gatherers" fresco of the "Xeste 3" building. It is one of many depicting saffron; they were found at the Bronze Age settlement of Akrotiri, on the Aegean island of Santorini.

more than three millennia.^[18] The wild precursor of domesticated saffron crocus was *Crocus cartwrightianus*. Human cultivators bred wild specimens by selecting for unusually long stigmas; thus, a sterile mutant form of *C. cartwrightianus*, *C. sativus*, likely emerged in late Bronze Age Crete.^[12]

4.1 Eastern

Saffron was detailed in a 7th-century BC Assyrian botanical reference compiled under Ashurbanipal.^[15] Documentation of saffron's use over the span of 4,000 years in the treatment of some 90 illnesses has been uncovered.^[40] Saffron-based pigments have indeed been found in 50,000 year-old depictions of prehistoric places in northwest Iran.^{[41][42]} The Sumerians later used wild-growing saffron in their remedies and magical potions.^[43] Saffron was an article of long-distance trade before the Minoan palace culture's 2nd millennium BC peak. Ancient Persians cultivated Persian saffron (*Crocus sativus* 'Hausknechtii') in Derbena, Isfahan, and Khorasan by the 10th century BC. At such sites, saffron threads were woven into textiles,^[41] ritually offered to divinities, and used in dyes, perfumes, medicines, and body washes.^[44] Saffron threads would thus be scattered across beds and



Buddhist adepts pray in the Hundred Dragons Hall, Buddha Tooth Relic Temple and Museum, Singapore, wearing saffron-coloured robes.

mixed into hot teas as a curative for bouts of melancholy. Non-Persians also feared the Persians' usage of saffron as a drugging agent and aphrodisiac.^[45] During his Asian campaigns, Alexander the Great used Persian saffron in his infusions, rice, and baths as a curative for battle wounds. Alexander's troops imitated the practice from the Persians and brought saffron-bathing to Greece.^[46]

Conflicting theories explain saffron's arrival in South Asia. Kashmiri and Chinese accounts date its arrival anywhere between 2500–900 years ago.^{[47][48][49]} Historians studying ancient Persian records date the arrival to sometime prior to 500 BC,^[7] attributing it to a Persian transplantation of saffron corms to stock new gardens and parks.^[50] Phoenicians then marketed Kashmiri saffron as a dye and a treatment for melancholy. Its use in foods and dyes subsequently spread throughout South Asia. Buddhist monks wear saffron-coloured robes; however, the robes are not dyed with costly saffron but turmeric, a less expensive dye, or jackfruit.^[51] Monks' robes are dyed the same colour to show equality with each other, and turmeric or ochre were the cheapest, most readily available dyes. Gamboge is now used to dye the robes.^[52]

Some historians believe that saffron came to China with Mongol invaders from Persia.^[53] Yet saffron is mentioned in ancient Chinese medical texts, including the forty-volume pharmacopoeia titled *Shennong Bencaojing* (神农本草经): "Shennong's Great Herbal", also known as *Pen Ts'ao* or *Pun Tsao*, a tome dating from 300–200 BC. Traditionally credited to the fabled Yan ("Fire") Emperor (炎帝) Shennong, it discusses 252 phytochemical-based medical treatments for various disorders.^[54] Nevertheless, around the 3rd century AD, the Chinese were referring to saffron as having a Kashmiri provenance. According to Chinese herbalist Wan Zhen, "[t]he habitat of saffron is in Kashmir, where people grow it principally to offer it to the Buddha." Wan also reflected on how it was used in his time: "The flower withers after a few days, and

then the saffron is obtained. It is valued for its uniform yellow colour. It can be used to aromatise wine.”^[49]

4.2 Wider Near East, Western Europe and the USA



Preserved “saffron”, Staatliches Museum für Naturkunde, Karlsruhe, Germany.

The Minoans portrayed saffron in their palace frescoes by 1600–1500 BC; they hint at its possible use as a therapeutic drug.^{[40][55]} Ancient Greek legends told of sea voyages to Cilicia, where adventurers sought what they believed were the world’s most valuable threads.^[22] Another legend tells of Crocus and Smilax, whereby Crocus is bewitched and transformed into the first saffron crocus.^[41] Ancient perfumers in Egypt, physicians in Gaza, townspeople in Rhodes,^[56] and the Greek *hetaerae* courtesans used saffron in their scented waters, perfumes and pot-pourris, mascaras and ointments, divine offerings, and medical treatments.^[45]

In late Hellenistic Egypt, Cleopatra used saffron in her baths so that lovemaking would be more pleasurable.^[57] Egyptian healers used saffron as a treatment for all varieties of gastrointestinal ailments.^[58] Saffron was also used as a fabric dye in such Levantine cities as Sidon and Tyre.^[59] Aulus Cornelius Celsus prescribes saffron in medicines for wounds, cough, colic, and scabies, and in the mithridatium.^[60]

Such was the Romans’ love of saffron that Roman colonists took it with them when they settled in southern Gaul, where it was extensively cultivated until Rome’s

fall. Competing theories state that saffron only returned to France with 8th-century AD Moors or with the Avignon papacy in the 14th century AD.^[61]

European saffron cultivation plummeted after the Roman Empire went into eclipse. As with France, the spread of Islamic civilisation may have helped reintroduce the crop to Spain and Italy.^[62] The 14th-century Black Death caused demand for saffron-based medications to peak, and Europe imported large quantities of threads via Venetian and Genoan ships from southern and Mediterranean lands such as Rhodes. The theft of one such shipment by noblemen sparked the fourteen-week long *Saffron War*.^[63]

The conflict and resulting fear of rampant saffron piracy spurred corm cultivation in Basel; it thereby grew prosperous.^[64] The crop then spread to Nuremberg, where endemic and insalubrious adulteration brought on the *Safranschou* code—whereby culprits were variously fined, imprisoned, and executed.^[65]

Saffron cultivation was introduced into England in around 1350, the story being that corms were smuggled from the Levant in a special hollow compartment of a pilgrim’s staff.^[66] The crop seems to have been initially grown in monastic gardens for medicinal use, only being planted in the less kind conditions of open fields many decades later. Soil and climatic conditions meant that by the sixteenth century, saffron cultivation had centred on Eastern England. The Essex town of Saffron Walden, named for its new speciality crop, emerged as a prime saffron growing and trading centre. However, an important omission in a botanical book published in the 1790s meant that the true extent of saffron growing in the eastern counties has been long overlooked.^[67] North Norfolk (especially the area around Walsingham), southern Cambridgeshire and a small area of west Suffolk also produced saffron. Some was also grown in Gloucestershire and other “Westerlie Parts” according to one source. The evidence for this comes from several angles including tithe records, estate records and field names. In Norfolk, customs records show locally grown saffron was exported to the Low Countries.^[68] (The crop has recently been re-introduced to Norfolk and award-winning ISO 3632 category I saffron is grown at Burnham Norton.)

However, an influx of more exotic spices—chocolate, coffee, tea, and vanilla—from newly contacted Eastern and overseas countries caused European cultivation and usage of saffron to decline.^{[69][70]} The last grower in England appears to have been John Knott of Duxford in Cambridgeshire, who delivered his crop to London apothecaries until around 1818.^[71] It would be nearly two centuries before saffron was commercially grown in England again. Only in southern France, Italy, and Spain did the clone significantly endure.^[72]

Europeans introduced saffron to the Americas when immigrant members of the Schwenkfelder Church left Europe with a trunk containing its corms. Church mem-

bers had grown it widely in Europe.^[38] By 1730, the Pennsylvania Dutch cultivated saffron throughout eastern Pennsylvania. Spanish colonies in the Caribbean bought large amounts of this new American saffron, and high demand ensured that saffron's list price on the Philadelphia commodities exchange was equal to gold.^[73] Trade with the Caribbean later collapsed in the aftermath of the War of 1812, when many saffron-bearing merchant vessels were destroyed.^[74] Yet the Pennsylvania Dutch continued to grow lesser amounts of saffron for local trade and use in their cakes, noodles, and chicken or trout dishes.^[75] American saffron cultivation survives into modern times, mainly in Lancaster County, Pennsylvania.^[38]

5 Trade and use

Main article: Trade and use of saffron

5.1 Trade



"Ispanya saffron" at market in Turkey.



Sale of saffron and other spices in Iran

Almost all saffron grows in a belt bounded by the Mediterranean in the west, and the rugged region encompassing Iran and Kashmir in the east. The other continents, except Antarctica, produce smaller amounts. Some 300 t (300,000 kg) of dried whole threads and powder are gleaned yearly,^[14] of which 50 t (50,000 kg) is top-grade "coupe" saffron.^[77] Iran answers for around 90–93% of global production and exports much of it.^[16] A few of Iran's drier eastern and southeastern provinces, including Fars, Kerman, and those in the Khorasan region, glean the bulk of modern global production. In 2005, the second-ranked Greece produced 5.7 t (5,700.0 kg), while Morocco and Kashmir, tied for third rank, each produced 2.3 t (2,300.0 kg).^[16]

In recent years, Afghan cultivation has risen. Azerbaijan, Morocco, and Italy are, in decreasing order, lesser producers. Prohibitively high labour costs and abundant Iranian imports mean that only select locales continue the tedious harvest in Austria, England, Germany, and Switzerland—among them the Swiss village of Mund, whose annual output is a few kilograms.^[14] Tasmania,^[78] China, Egypt, England (at a tiny village in the county of Norfolk) France, Israel, Mexico, New Zealand, Turkey (mainly around the town of Safranbolu), California, and Central Africa are microscale cultivators.^{[4][29]}

To glean 1 lb (450 g) of dry saffron requires the harvest of 50,000–75,000 flowers; a kilogram requires 110,000–170,000 flowers.^{[79][80]} Forty hours of labour are needed to pick 150,000 flowers.^[81] Stigmas are dried quickly upon extraction and (preferably) sealed in airtight containers.^[82] Saffron prices at wholesale and retail rates range from US\$500 to US\$5,000 per pound, or US\$1,100–11,000/kg, equivalent to £2,500/€3,500 per pound or £5,500/€7,500 per kilogram. The price in Canada recently rose to CA\$18,000 per kilogram. In Western countries, the average retail price in 1974 was \$1,000/£500/€700 per pound, or US\$2,200/£1,100/€1,550 per kilogram.^[4] In February 2013, a retail bottle containing 0.06 ounces could be purchased for \$16.26 or the equivalent of \$4,336 per pound or as little as about \$2,000/pound in larger quantities. A pound contains between 70,000 and 200,000 threads. Vivid crimson colouring, slight moistness, elasticity, and lack of broken-off thread debris are all traits of fresh saffron.

5.2 Use

Saffron's aroma is often described by connoisseurs as reminiscent of metallic honey with grassy or hay-like notes, while its taste has also been noted as hay-like and sweet. Saffron also contributes a luminous yellow-orange colouring to foods. Saffron is widely used in Indian, Persian, European, Arab, and Turkish cuisines. Confectioneries and liquors also often include saffron. Common saffron substitutes include safflower (*Carthamus tinctorius*, which is often sold as "Portuguese saffron" or



Crushed saffron threads are soaked in hot—but not boiling—water for several minutes prior to use in cuisine. This helps release the beneficial components.

“açafraão”), annatto, and turmeric (*Curcuma longa*). Saffron has also been used as a fabric dye, particularly in China and India, and in perfumery.^[83] It is used for religious purposes in India, and is widely used in cooking in many cuisines, ranging from the Milanese *risotto* of Italy to the *bouillabaisse* of France to the *biryani* with various meat accompaniments in South Asia.

Saffron also has a long history of use in traditional medicine.^[84]

5.3 Biomedical research

There is some evidence to suggest that saffron may help alleviate the symptoms of major depressive disorder.^{[85][86]} Preclinical studies indicate that saffron could be a promising candidate for cancer chemoprevention studies.^[87] Early studies suggest that it may protect the eye from the direct effects of bright light, and from retinal stress in addition to slowing down macular degeneration and retinitis pigmentosa.^[88] (Most saffron-related research refers to the stigmas, but this is often not made explicit in research papers.) Some studies suggest that saffron may help relieve the symptoms of premenstrual syndrome.^{[89][90]}

6 See also

Topics related to saffron:

- History
- Trade and use

7 Notes

- [1] “Folate” refers only to the naturally occurring form of folic acid; the sample contains no folic acid per se.^[76]

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10 External links

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