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Using, History, Botany of Sesame (Sesamum Indicum L.) and Cultivation Technology

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A B S T R A C T
This article provides information on the nutritional value, history of origin and distribution, systematics, and cultivation technology of sesame, a member of the oilseed crop group, in the condition of the Republic of Uzbekistan.

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Introduction

Using. Sesame belongs to the oldest cultivated oilseeds. Its seeds contain 48-63% of oil, 16-19% of protein, and 17% of soluble carbohydrates. Sesame oil is one of the best edible oils, approaching the taste of olive (Provencal). Its iodine number is 103-112. Cold extracted oil has a light-yellow color and excellent taste. It is used for the preparation of confectionery, the best canned food and margarine, as well as for medical purposes. From the soot formed during the burning of sesame oil, extracted in a hot way, they get high-quality mascara. Shelled and ground sesame seeds are used to prepare the highest grades of halvah (tahini halva). Whole seeds of sesame are used for sprinkling rolls, bagels, making sweets and Oriental sweets. Sesame oilcake contains 40% of protein, 8% of oil, and it is used in the confectionery industry and for animal feed.[1]

Sesame (/ˈsɛsəmi/;[2][3]*Sesamum indicum*) is a plant in the genus *Sesamum*, also called **benne.**[4] Numerous wild relatives occur in Africa and a smaller number in India. It is widely naturalized in tropical regions around the world and is cultivated for its edible seeds, which grow in pods. World production in 2018 was 6 million tonnes (5.9 million long tons), with Sudan, Myanmar, and India as the largest producers. [33]



Sesame oil



Jian dui covered with sesame seeds



Tahini made of sesame seed paste



Sesame seeds are often added to baked goods and confectionery

Sesame seed is one of the oldest oilseed crops known, domesticated well over 3,000 years ago. *Sesamum* has many other species, most being wild and native to sub-Saharan Africa. *S. indicum*, the cultivated type, originated in India. It tolerates drought conditions well, growing where other crops fail. Sesame has one of the highest oil contents of any seed. With a rich, nutty flavor, it is a common ingredient in cuisines around the world. Like other foods, it can trigger allergic reactions in some people and is one of the nine most common allergens outlined by the Food and Drug Administration.

In Asia, sesame seeds are sprinkled onto sushi-style foods.[24] In Japan, whole seeds are found in many salads and baked snacks, and tan and black sesame seed varieties are roasted and used to make the flavoring *gomashio*.[25] Ground black sesame and rice form zhimahu, a Chinese dessert and breakfast dish.[26] The seeds and oil are used extensively in India, where sesame seeds mixed with heated jaggery, sugar, or palm sugar are made into balls and bars similar to peanut brittle or nut clusters and eaten as snacks, such as *chikki*.[27]

Sesame is a common ingredient in Middle Eastern cuisine. The seeds are made into *tahini* paste and sweet *halva*. It is a common component of the Levantine spice mixture *za'atar*, popular throughout the Middle East.[28][29]

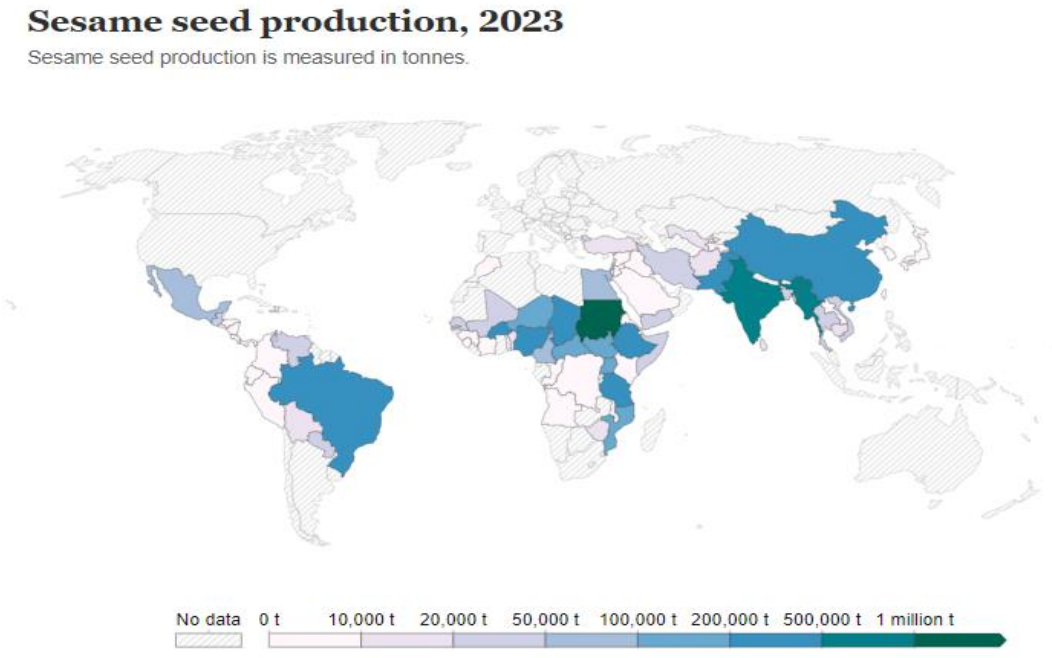
In Southern Italian cuisine, traditional sesame seed confections are one of many culinary remnants of the Arabic period. These include a brittle-style torrone served at Christmas known as Giurgiu Lena (from the Arabic *juljulàn*) and a lightly sweet, seed-covered biscuit called reginelle or sesamini.[30] Similar sweets are found in neighboring cultures throughout the Mediterranean.[31]

Sesame oil is sometimes used for cooking, though not all varieties are suitable for high-temperature frying. The "toasted" form of the oil (as distinguished from the "cold-pressed" form) has a distinctive pleasant aroma and taste, and is sometimes used as a table condiment.[32]

Origins and history

Sesame seed is considered to be the oldest oilseed crop known to humanity.[7] The genus has many species, and most are wild and native to sub-Saharan Africa.[8] *Sesamum indicum*, the cultivated type,[9][10] originated in India.[5][11][8]

Archaeological remnants of charred sesame dating to about 3500-3050 BC shows that sesame was domesticated in the Indian subcontinent at least 5500 years ago.[12][13] The archaeobotanist Dorian Q. Fuller states that trading of sesame between Mesopotamia and the Indian subcontinent occurred by 2000 BC.[14] It is possible that the Indus Valley civilization exported sesame oil to Mesopotamia, where it was known as *ilu* in Sumerian and *ellu* in Akkadian, similar to the Dravidian languages Kannada and Malayalam *eḷḷu*, Tamil *eḷ*.[15]



Sesame was cultivated in ancient Egypt.[16] Egyptians called it *sesemt*, and it is included in the list of medicinal drugs in the scrolls of the c. 1550 BC *Ebers Papyrus*. Excavations of King Tutankhamen uncovered baskets of sesame among other grave goods, suggesting that sesame was present in Egypt by 1350 BC.[17] Sesame was grown and pressed to extract oil at least 750 BC in the empire of Urartu.[13] Others believe it may have originated in Ethiopia.[18]

Historically, sesame was favored for its ability to grow in areas that do not support the growth of other crops. It is a robust crop that needs little farming support - it grows in drought conditions, in high heat, with residual moisture in soil after monsoons are gone or even when rains fail or when rains are excessive. It can be grown by subsistence farmers at the edge of deserts, earning it the name of survivor crop from the sesame breeder Derald Ray Langham.[19]

Botanical and biological characteristics. Sesame is a perennial plant growing 50 to 100 cm (1 ft 8 in to 3 ft 3 in) tall, with opposite leaves 4 to 14 cm (2 to 6 in) long with an entire margin; they are broad lanceolate, to 5 cm (2.0 in) broad, at the base of the plant, narrowing to just 1 cm (0.39 in) broad on the flowering stem. The flowers are tubular, 2.5 to 3 cm (0.98 to 1.18 in) long.[20] The flowers vary in color, from white to pink or purple.[21]

The fruit is a capsule, normally pubescent. The length of the fruit capsule varies from 2 to 3 cm (0.79 to 1.18 in), its width varies between 0.6 and 1.2 cm (0.24 and 0.47 in); there are four locules. The seeds are either white or black.[20]

Sesame seeds are small. Their sizes vary widely by cultivar. Typically, the seeds are 3 to 4×2×1 mm (0.12 to 0.16×0.08×0.04 in). The seeds are ovate, slightly flattened, and somewhat thinner at the eye of the seed (hilum) than at the opposite end. The mass of 100 seeds sampled from a market in Ibadan, Nigeria is 0.203 g, meaning that one gram of sesame consists of around 493 seeds.[22]

Sesame was described as the species *Sesamum indicum* by Carl Linnaeus in 1753.[23]

Sesame cultivated Indian – *Sesamum indicum L.* is an annual plant of the Sesame family (*Pedaliaceae*). Sesame has taproot, penetrating to a depth of 1 m, and its upper part is branched and rather thick.

Stem is erect (sometimes there are bushes of sprawling form), height is 50-150 cm, branched, haired with fine hairs.

Leaves are petiolate, alternate or opposite, haired. The shape of the leaf depends on its position on the stem. In some varieties, all the leaves are whole, the lower ones are large and wide, they decrease upwards, in others – the lower leaves are dissected, while the upper ones are whole, narrow, and lanceolate.

Flowers of the five types, consist of a tubular bell-shaped corolla and a small five-part calyx. One, sometimes three flowers sit in the leaf bosom. The color of the corolla, depending on the ecotype, varies from white to intense violet. Calyx and corolla are trimmed. Sesame is self-pollinator, but cross-pollination by bees is also possible.

The fruit is an elongated four or octahedral box with a round base and a conical tip, which consists of two or four carpels. In some forms, the edges of the carpels are wrapped inward and form false partitions; in others, these partitions do not exist. When ripe, the boxes open, breaking up into carpels. At the same time, seeds fall off, especially easy for forms without partitions. Boxes are large (3-4 cm long) and small (up to 3 cm). There are 100-150 pieces on one plant.

Seeds are located in the nests of the box in the form of flat vertical columns - stacks in 4 or 8 rows. Seeds are small, weight of 1000 pcs. is 2.5-5 g. The shape is similar to flaxseed, flat, but with a matte surface, sometimes rough. The color is varied, most often brownish, white and black.

Subspecies and varieties of sesame

Sesame is distinguished by a significant variety of forms and its systematics has been developed by different authors several times. The most complete classification of it made by V. M. Giltebrant, which took into account the morphological features, the distribution area and the biological characteristics of the plant. According to this classification, cultural sesame is divided into two subspecies:

1. *Sesamum indicum ssp. bicarpella-turn Hilt.* The box consists of two carpels, a convex rectangle in cross section. Corolla is accrete from five petals. The cup is five-fold. The stigma of the pistil is two-bladed.
2. *Sesamum indicum ssp. quadricar-pellatum Hilt.* The box consists of two carpels, with a convex rectangle in the cross section. Corolla is fused from five petals. The calyx is five-lobed. The stigma of the pistil is two-lobed.

The most common is a subspecies with two carpels. Within this subspecies there are groups of varieties: Asiatic – *proles asiaticum Hilt*, and Abyssinian – *proles abyssinicum Hilt*.

Plants are of Asian group with medium power. The leaves at the bottom of the stem are whole or weakly dissected, medium in width, narrow at the top.

The plants of the Abyssinian group are powerful, the foliage is strong. Leaf blades are wide. The varieties of this group are more moisture-loving, relatively late-maturing and do not have wide industrial significance, with the exception of the regions of Transcaucasia.

It is a thermophilic and light-loving short-day plant, requiring clean and fertile soils. At the same time, it is drought-resistant and heat resistant. Seeds begin to germinate at a temperature not lower than 15-16°C. Shoots die during frosts of -1°C. Sesame stops growing at temperatures below 15°C. The optimum temperature is 22-25°C. The first 30-45 days of growing season it grows very slowly and weeds can cause damage during this period. The vegetation period, depending on the variety and crop conditions, ranges from 80 to 120 days.

The best soils for sesame are black earth, light loam and sandy loam, sierozem.

Varieties: Tashkent-122, Kora Shakhzoda

Cultivation technology. Sesame requires careful tillage and high nutrient availability. The main preceding crops are legumes, corn, sorghum, and alfalfa. On one field sesame returns after 6-7 years. 10-15 t / ha of manure, 60-80 kg of phosphorus are applied to plowing. In the spring, before sowing, 20-30 kg of nitrogen is applied; during the growing season, fertilizing is twice carried out at 40-50 kg / ha. Plowing is carried out at a depth of 25-27 cm. The saline soils are leached. Spring harrowing and 1-2 cultivation are carried out before sowing of previous crop. The rate, timing and methods of applying mineral fertilizers depend on the level of agricultural fertility of the soil. For planting they use seeds with a germination rate of 85-85%. Sesame is sown in May. As stubble crops are sown in June 10-15. Sesame is sown in a wide-row method with a spacing of 60-70 cm. Sesame seeds are sown in moist soil when the sowing layer warms up to 15-16°C, grain drills with row spacing of 45-70 cm. Sowing rate is 5-6 kg / ha of seeds, sowing depth is 2.5-3.0 cm. After sowing, watering is done to seed germination. During the growing season, 2-3 cultivations, 1-2 watering before flowering, and 2 watering with flowering are carried out. Irrigation is reduced with a close location of groundwater.

When ripe, the plant turns yellow, the leaves fall off, the lower boxes crack. The crop is mowed by mowers, tied up in bunches and suspended so that the boxes open. Seeds are showered, they are collected and cleaned. If the boxes do not crack they are threshed, cleaned the seeds.

Conclusion. Sesame seeds contain 48-63% of oil, 16-19% of protein, and 17% of soluble carbohydrates. Sesame oil is one of the best edible oils, approaching the taste of olive (Provencal). Its iodine number is 103-112. Cold extracted oil has a light-yellow color and excellent taste. It is used for the preparation of confectionery, the best canned food and margarine, as well as for medical purposes. Reading the information provided in this article will allow you to learn about the importance of sesame in food and confectionery, its history of origin and distribution, systematics, and cultivation technology.

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