

Basil

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Common Names

English: basil

French: basilic

German: basilikum, basilienkraut

Indian: tulsi

Italian: basilico

Spanish: albahaca

Scientific Names

Species: *Ocimum basilicum* L.

Family: Lamiaceae (Labiatae)

Uses

Cultivated as a culinary herb, condiment or spice; source of essential oil for use in foods, flavors, and fragrances; garden ornamental. The green aromatic leaves are used fresh and dried as flavorings or spices in sauces, stews, salad dressings, vegetables, poultry, vinegar, confectionery products, and the liqueur chartreuse. Basil extract has been reported to have antioxidant activity. Cultivars with purple foliage, such as 'Dark Opal' and var. *aurantascens*, are grown as ornamentals, but can also be used as flavorings. The essential oils and oleoresin are used extensively, reducing the need for dried leaves in the food industry; used in perfumes, soaps, and shampoos.

Origin

Tropical Old World: central Africa and Southeast Asia.

Crop Status

An annual herb; cultivated extensively in France, Egypt, Hungary, Indonesia, Morocco, and the United States (Arizona, California, New Mexico, NorthCarolina), Greece and Israel.

Basil is cultivated for the freshmarket as a culinary herb, as a condiment or spice in the dried/frozen leaf form, and as a source of aromatic essential oil for use in foods, flavors, and fragrances and as a potted herb and bedding plant. As a fresh or dried market herb, the main type traded includes the large leaf highly aromatic French or Italian basil, though several other types which differ in leaf shape and aroma are of commercial importance in the fresh market industry (i.e. basils with lemon, licorice or cinnamon aroma).

The world market for basil oil is dominated by two main types, the European and Egyptian basil oils. The European sweet basil, cultivated and distilled in Europe, the Mediterranean region, and the United States is considered to be of the highest quality, producing the finest odor. Characteristically, the essential oil from this basil contains high concentrations of linalool and methyl chavicol (estragole), at a ratio of 2 or 3:1. Other constituents found in low concentrations include: 1,8-cineole, eugenol, alpha-terpeniol, beta-caryophyllene, geraniol, sabinene, alpha-phellandrene, gamma-terpinene, thujone, myrcene, limonene, ocimene, and para-cymene. The Egyptian basil oil is similar but with a much higher concentration and ratio of methyl chavicol relative to linalool. Other distinct types of basil oil traded on the international market and which differ in aroma include the Comoro (also called Reunion or African basil oil), originally distilled only on Reunion Isle but now grown and distilled throughout many parts of Africa, Madagascar, and the Seychelles Islands which has a licorice and or camphoraceous fragrance. The main constituent of this basil oil is methyl chavicol, with camphor sometimes present, but little if any linalool, alpha-pinene, eugenol, or 1,8-cineole. A Bulgarian or cinnamon basil oil, rich in methyl cinnamate is also traded as a natural source of methyl cinnamate.

GRAS Status

Sweet basil is generally recognized as safe as a spice/natural flavoring and as a plant/oil extract (21 CFR sections 182.10, 182.20 [1982]).

Toxicities

None from the plant or plant extract reported, though some lines of basil contain the polypropanoid, methyl chavicol, which is under review as a possible carcinogen.

TraditionalMedicinal Uses

Traditionally, basil has been used as a medicinal plant in treatment of headaches, coughs, diarrhea, constipation, warts, worms, and kidney malfunctions. It is also thought to be an antispasmodic, stomachache, carminative, stimulant and insect repellent. The oils of basil, especially the camphor-containing oil, have antibacterial properties. Volatile compounds produced by sweet basil have been shown to influence the composition, distribution, and spore germination of some fungal populations. The volatile terpenes camphor and 1,8-cineole present in basil and other members of the Lamiaceae have been suggested as agents in allelopathic reactions.

Botany

Taxonomy

The correct botanical nomenclature for the *Ocimum* species and varieties from which commercial basil is obtained has been of great concern, since more than 50 species and forms have been recorded, making questionable the true botanical identity of the basil cited in some literature. The difficulty in classifying the more than 60 varieties of *Ocimum basilicum* L. has been attributed to the plant's polymorphic character and cross-pollination, resulting in large numbers of subspecies, varieties, and forms. The probable occurrence of seed from distinctive but erroneously named intergrades between *O. basilicum* and closely related species has been recognized and there is a need to taxonomically reclassify the genus. Many other *Ocimum* species are cultivated and utilized throughout the world, although none are as economically important as sweet basil. *O. sanctum* L. (holy basil), an annual native to Malaysia, Australia, India, and western Asia, has a strong, pungent, clove-like odor because of its high eugenol content, and is used fresh and dried as a flavoring or spice. Holy basil, considered the most sacred plant in the Hindu religion, is grown extensively in India, and many cultivars have been recorded. A methyl-cinnamate-type basil oil is distilled from *O. canum* Sims., formerly *O. americanum* L., in Africa, the East Indies, and Belgium. *O. citriodorum* Vis., or lemon basil, has a strong lemon scent, though whether this lemon basil constitutes a separate species is unclear. *O. kilimandscharicum* Guerke, types of which are called African Blue basil or camphor basil (due to a strong, pungent camphor odor) are used locally and have not entered into the commercial international market, but are becoming available as ornamental in US trade. *O. gratissimum* L. (sometimes called tree basil), is a perennial, woody basil grown in southeast Asia, reaches a height of 2 m and has a powerful clove scent because of the high phenol content of eugenol. Other

chemotypes reported to be high in thymol and geraniol, respectively have been reported and could serve as natural sources for these chemicals. *O. suave* Willd., or tree basil, is a densely woody shrub, reaching heights of 2 to 3 m and found in India and Africa. *O. crispum*, an erect basil from Japan, is now correctly classified as *Perilla frutescens* cv. *crispum*. *O. minimum*, bush basil, used as a border plant, is considered by many to be a dwarf form of sweet basil, *O. basilicum* L. The spice basil grown by some American farmers and gardeners may actually be *O. sanctum* L. or a hybrid, rather than *O. basilicum*, as morphologically it is distinct from *O. basilicum*.

Crop Culture (Agronomy/Horticulture)

Ecology

Sweet basil is cultivated in agroclimates between 7 to 27 C, with 0.6 to 4.2 m annual precipitation and soil pH 4.3 to 8.2. The tender herbaceous annual, which is susceptible to frost and cold-temperature injury, develops best under long days, in full sun, and well-drained soils.

Cultivars

Many cultivars are available, often named after the type of aroma they emit. Basils may look almost identical but have distinct aromas, yet others which appear different may exhibit a similar aroma. Seed populations obtained by many seed companies are not necessarily genetically uniform. Selected cultivars (from seed) include:

- Sweet basils: Sweet, Genovese, Large-leaf, Mammoth
- Purple foliage basils: Dark Opal, Purple Ruffles
- Lemon basils: Lemon-Scented, Lemon, Sweet Dani
- Others: Cinnamon basil, Spicy Bush, Camphor, Anise, Licorice

Production practices

Basil can be direct seeded or transplanted to the field in late Spring after all danger of frost has passed. The germination rate of the seed should be above 80 %. If the soil is heavy, an antirustant may be used. Soil should be kept moist to hasten germination and to improve stand establishment. Seeds are small and should be planted shallow (ca.0.3 cm).

Commercially, an onion seeder will sow basil effectively. Seed bed should be friable, well-tilled and uniform. Emergence occurs after 8-14 days. Initial growth is slow, but after a few sets of leaves have emerged, growth rate increases significantly. Most small growers raising basil as an annual crop for the fresh market use transplants, rather than direct field sowing. Transplants are easy to produce and normally require 4-6 weeks of growth. Lateral branching and growth may be encouraged by topping when plants are about 12 cm in height. Optimum population density is in part dependent upon end use, high density can be used if compatible farm equipment are available for mechanical cultivation and harvesting. Rows 60 to 90 cm apart, with plants spaced every 15 cm. are commonly used. Basil can also be planted in raised beds of three rows, 30 cm. apart between rows. Distance between beds are dependent on growers equipment, and generally range from 24 to 36. Large variations in growth and yield should be expected due to climatic conditions, plant types, and cultural and management practices. Fertilizer applications depend upon soil type, cropping history. Basil responds well to moderate fertility, and a N-P₂O₅-K₂O ratio of 1-1-1 can be used successfully, with a N rate of 230-300 kg of actual N/ha applied as a broadcast and plowdown. Nitrogen sidedressing at rates of 50-75 kg actual N/ha are suggested following each harvest. Basil is intolerant to water stress at any stage of development. A regular and even supply of water at rates used for most herbaceous vegetable crops will provide ample water. There are no national or state herbicide registrations for basil in the USA. This means that basil must be grown without herbicides. If basil is imported and sold for consumption in the USA it must be free of herbicide residues. As such, mechanical cultivation, high plant populations, use of mulch and manual weeding are among the choices for weed control. The presence of weeds in fresh, dry or processed basil leaves can decrease the quality of the final product. There are several insects and diseases that may infest basil, including fusarium.

Harvesting

The plant part harvested depends upon projected use. Where basil is grown for its dried leaves, it is cut just prior to the appearance of flowers. For essential oil, it is harvested during full bloom. In the Mediterranean areas, and other countries with similar climates, basil can be grown as a short-lived perennial, with 3-5 cuttings per year. In the more northern temperate zones, the growing season is long enough for one, sometimes two cuts. Where two cuts are practiced, the first is generally early in the summer, and the yield relatively low, and the second just prior to open bloom. For the fresh and dried market, basil is harvested for its leaves, and the plant cut above the bottom two to four sets of true leaves. For the fresh market, the length of the stem may be important, as is the pack or bundle size and weight. For larger scale commercial harvesting, a modified sickle bar/ jerry mover with an adjustable cutting height can be used. Leaves can be cut when needed. To allow for regrowth, cutting should be at least 10-15 cm above the ground. To ensure

a continuous supply of fresh leaves, the field harvest and planting dates are normally staggered.

Processing

As the quality of the product, associated with color and aroma retention, is strongly influenced by postharvest handling, leaves and flowering tops are dried at low temperatures (<35C) to retain maximum color before grinding to marketable size or distilling for essential oil. Leaves should be washed and cleaned, with weeds and all extraneous materials removed. Basil is very sensitive to chilling injury. For essential oil, the cut basil is normally cut, then field dried for 1-3 days before the material is collected and distilled.

Germplasm

Collections

USDA North Central Regional Plant Introduction Station
Ames, Iowa

Commercial Seed Sources

Burpee Vegetables

300 Park Avenue, Warminster, PA 18974.

Harris Moran Seed Company

60 Saginaw Drive, P.O. Box 22960, Rochester, NY 14624.

Johnny's Selected Seeds

Foss Hill Road, Albion, MA 04910-9731.

Park Seed Company

P.O. Box 31, Greenwood, SC 29646.

Richter's Herbs

Box 26, Goodwood, Ontario, Canada.

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