

Syzygium aromaticum

(L.) Merr. & Perr.

Myrtaceae

LOCAL NAMES

Amharic (k'rinfudm); Arabic (qaranful); Burmese (ley nyim bwint,lay-hnyin); Chinese (ding heung,ting hsiang); Dutch (kruidnagel); English (clove tree); French (giroflier,clou de girofle); German (gewürznelke,nelke,Gewuerznelkenbaum); Greek (garifalo); Gujarati (lavang); Indonesian (cenkeh); Italian (chioda di garofano,chiodo di garofano,claventino); Japanese (choji); Lao (Sino-Tibetan) (kaanz phuu); Malay (bunga cingkeh); Portuguese (cravo); Spanish (clavo de olor,clavo de especia,clavo); Swahili (karafuu); Swedish (kryddnejlikor,nejlikor); Thai (khan plu,kan phlu); Turkish (karanfil); Vietnamese (dinh huong,hanh con)



Fruit and foliage (Trade winds fruit)

BOTANIC DESCRIPTION

Syzygium aromaticum is a small-medium sized evergreen tree, 8-30 m tall. Canopy medium sized, crown base low. Branches semi-erect and numerous.

Leaves glabrous, with numerous oil glands on lower surface.

Flowers small, in terminal cymose clusters, each peduncle bears 3-4 stalked flowers at the end. Sepals minute triangular projections.

Fruit olive-shaped, 1-seeded, popularly referred to as 'mother of clove'.

Most of the plant's parts are aromatic (leaves, flowers and bark). The brown, dried, unopened flower buds are called cloves, a name coming from the French "clou" meaning nail. Cloves are from a genus of 400-500 species of evergreen trees and shrubs. The generic name is derived from the Greek *syzygios* (paired), on account of the leaves and twigs that in several species grow at the same point. The specific epithet means aromatic.

BIOLOGY

The clove tree is monoecious, flowers are hermaphrodite and self-pollinating. The tree matures between 8-10 years after planting. Fruits mature approximately 9 months after flower initiation and are considered physiologically mature when the exocarp turns reddish-purple in colour. Flowering varies between areas, in India flowering is from February-May, in Zanzibar (Tanzania) July-September and October-January. Fruiting normally occurs 5-6 months after flowering.

ECOLOGY

S. aromaticum is commonly found in woodland and rainforest.

BIOPHYSICAL LIMITS

Altitude: 0-1 000 m

Mean annual temperature: 25 deg C

Mean annual rainfall: 1 500-2 500 mm.

Soil type: Grown in loamy humus-rich soils, also in deep and loose laterite soils.

DOCUMENTED SPECIES DISTRIBUTION

Native: Indonesia

Exotic: Brazil, Haiti, India, Kenya, Madagascar, Malaysia, Mauritius, Mexico, Seychelles, Sri Lanka, Tanzania



The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

PRODUCTS

Food: The spice of commerce is the unopened flower bud on the terminal shoots of the twigs. Cloves are used in spice cookies and cakes. Much of the world crop is used in Indonesia for the extremely popular clove aromatized cigarettes, called "kreteks. India also consumes a considerable amount of clove.

Essential oil: Clove oil is extracted by water distillation and mixes well with cinnamon, cedar, lavender, rose and bergamot. Essential oil content in good quality cloves may exceed 15%. The oil is dominated by eugenol (70-85%), eugenol acetate (15%) and beta-caryophyllene (5-12%). Cloves contain about 2% of the triterpene oleanolic acid.

Poison: Clove oil is very potent and can cause gum irritation, it is advisable to dilute it with equal amounts of vegetable oil. For infants even milder dilution is required. Use should be avoided during pregnancy, or if with sensitive skin.

Medicine: Taken internally (tea) for stomach upsets, chills and impotence. Flower buds chewed to freshen breath or ease toothache pain. Also applied externally (essential oil) for toothache, headache, cold, arthritis and rheumatism. Two little-known compounds in clove oil have shown "strong activity" against bacteria associated with plaque formation and gum disease. The oil is also useful for ulcers, bruises, burns, bronchitis, asthma, minor infections and colic. Sometimes used to ease nausea.

SERVICES

Shade or shelter: This multi-stemmed tree offers cool shade.

Intercropping: Clove can be interplanted in coconut farm, as many as 120 clove plants can be accommodated in 1 ha of coconut garden.

Ornamental: This is a beautiful tree suitable for gardens.

Other services: Jewish people smell cloves in the service that closes the Sabbath (Havdalah). Clove oil reportedly imparts spiritual uplifting, warming and stimulation benefits. In the Middle Ages people studded oranges with cloves as a protection against plague. They believed that this would ward off bad luck.

TREE MANAGEMENT

Initially, clove trees need shade from banana plants or albizias. Clove trees live for more than 100 years, the oldest tree recorded is aged 375 years in Indonesia. Generally, it takes 20-30 years for clove to attain full bearing. First bearing is 8-10 years after planting, in Zanzibar (Tanzania) 4-6 years and in Indonesia 6-8 years. They should be grown in deep, fertile, moist but well-drained soil in full sun or partial shade. The plants thrive well with periodical summer irrigation. The tree fails to flower in very moist conditions. Manuring is required regularly for proper growth and flowering. Shallow trenches about 50-150 cm away from the tree are dug for manure application. About 15 kg of organic manure and 18 g phosphorous, 50 g potash is applied per plant in the initial years, mature trees (15 years) get 40-50 kg applications of organic manure and 250 g phosphorous, 300 g nitrogen, 750 g potash. Organic manure is applied with commencement of the monsoons whereas fertilizers are applied twice from May-June and September-October. Mulching of trees with fallen leaves and application of river-silt are also beneficial. Weeding should be done at regular intervals. Thinning is recommended to reduce branch overcrowding in trees. Dead and diseased shoots should be removed once or twice a year. Harvesting is carefully done by hand-picking the pink unopened, eugenol rich flower bud. Average tree yield per year is 4 kg but in some years yields of 8-10 kg are recorded. Clove yield is significantly related to tree canopy size which in turn depends on the type of clove, soil and tree age. The buds are then sun dried for 4-6 days i.e. until the floral stalk is dark brown.

GERMPLASM MANAGEMENT

Seeds require a pretreatment of soaking in water for three days. Mature seeds have high vigour and better percentage of germination. There are about 1 100 seeds/kg.

PESTS AND DISEASES

Sumatra disease caused by the bacterium *Pseudomonas solanacearum* causes mass decline in plantations due to dieback. The fungus *Valsa eugeniae* causes sudden death characterized by heavy leaf fall, this disease is linked with water stress and wilting associated with it can be arrested by watering. Seedling wilt is caused by fungi such as *Colletotrichum* spp., *Rhizoctonia* sp. and *Trichoderma* sp. Leaf rot is caused by *Cylindrocladium guingiseptatum*. Leaf spot, necrotic lesions, twig blight and flower bud shedding are caused by *Colletotrichum gleosporioides*. The stem borer *Sahyadrassus malabaricus* is the most significant clove pest, the caterpillars bore into the main stem resulting in drastic drying of plant parts above the entry point, pouring a solution of 0.1% Quinalphos into the bore hole and plugging the opening checks further damage. Scales (*Lecanium psidii*) and mealy bugs (*Planococcus* sp., *Pseudococcus* sp.) damage tender shoots by sucking sap, usually well managed with 0.05% Monocrotophos or Dimethoate.

FURTHER READNG

Clifford AA, Annamaria B, Salim HR and Al-Saidi. 1999. A comparison of the extraction of clove buds with supercritical carbon dioxide and superheated water. *Fresenius' Journal of Analytical Chemistry*. 364(7): 635-637.

http://www.ang.kfunigraz.ac.at/~katzer/engl/generic_frame.html?spice_bot.html

Thampman PK (ed.). 1993. *Trees and tree farming*. Peekay Tree Crops Development Foundation. Kerala, India.

SUGGESTED CITATION

Orwa C, A Mutua, Kindt R , Jamnadass R, S Anthony. 2009 *Agroforestry Database: a tree reference and selection guide version 4.0* (<http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp>)