

LOCAL NAMES

Amharic (yergib ater,yewof ater); Burmese (pe-sinngon,pay-in-chong); English (Congo pea,pigeon pea,no-eye pea,red gram,angolan pea,yellow dhal); Filipino (kadios,kardis,tabios,kidis); French (ambrévade,pois pigeon,pois d'Angole,pois cajon); German (anglische erbse); Hindi (tuver,dhal,shu-tou,tur,arhar); Indonesian (arthar,kacang kayu,kacang gude,kacang Bali); Khmer (sândaèk klöng,sândaèk kroëb sâ,sândaèk dai); Lao (Sino-Tibetan) (thwàx h'è); Luganda (mpinnamiti); Malay (kacang Bali,kacang hiris,kacang gude); Mandarin (ki-mame); Portuguese (feijão boere); Sanskrit (tuvari,tuvarika,adhaki); Spanish (guisante de paloma,gandures,gandul); Swahili (mbaazi); Tamil (thovaray); Thai (thua maetaai,thua rae,togare,ma hae); Vietnamese (dau sang,cay dau chieu)

BOTANIC DESCRIPTION

Cajanus cajan is a glandular-pubescent, short-lived perennial (1-5 years) shrub, usually grown as an annual, 0.5-4 m high, with thin roots up to 2 m deep; stems up to 15 cm in diameter; branches many, slender.

Leaf rachis 1-2 cm long; petiole half as long or less; stipules acuminate, 2.5-5 mm long, persistent; leaflets lanceolate or narrowly elliptic, puberulent above and underside, the largest to 7.5-8 x 2.8-3.5 cm, acute apically, bases similar, venation strongly reticulate, prominent underneath.

Inflorescence axillary from a single peduncle, terminating at the insertion of 1-2 pedicels or continuing for 1-3 additional nodes, rarely branching, usually slightly shorter than the leaves, mostly with 2-6 flowers; bracts about 5 mm long; flowers about 2 cm long; pedicels to about 9 mm long; calyx tube 3-5 mm long, glandular and pubescent, the upper lobe bifid, the lower lobe longest, about 4 mm long; vexillary petal basally inflexed biauriculate, mostly with reddish striate, bicallose in the target area, glabrous, about 14 mm long, with a claw about 4 mm long.

Fruit a pod, linear-oblong, apex obtuse or acute, compressed, bivalved, depressed between the seeds, about 4 cm long, 1 cm wide, 3-4 mm thick; upper suture swollen, the lower indistinct; beak downcurved; seeds 1-5, compressed, about 6 x 4 x 1.5 mm, of various colours; the hilum linear-oblong to somewhat elliptic, about 3 mm long.

BIOLOGY

The bisexual flower may remain open for about 6 hours, pollen having been shed the previous day. The flowers of *C. cajan* are cleistogamous, a condition favouring self-pollination. But bees visit the flowers and there is about 20% cross-pollination. The factors affecting the extent of cross-pollination are the flowering habit of the cultivar and the types and numbers of insect pollinators. Only heavy insects can trip the flowers by depressing the keel petal and releasing the staminal column. Large wild bees can do this, including *Chalicodoma*, *Megachile* and *Xylocopa*.



Cultivated forms have larger seeds than their wild relatives and have been subjected to selection for larger seed. (Ellis RP)



Ripening pods (Cornell University)



Flower production is high relative to seed set. (Ellis RP)

ECOLOGY

As the species is not found truly in the wild, its natural habitat conditions are uncertain. It prefers grassy habitats in tropical, cold-free zones with optimum 600-1000 mm annual rainfall. However, it grows in humid areas with 2500 mm annual rainfall and in semi-arid areas with only 400 mm of rain annually.

BIOPHYSICAL LIMITS

Altitude: 0-2000 m, Mean annual temperature: 18-38 deg. C, Mean annual rainfall: 400-2500 mm

Soil type: *C. cajan* is grown in a wide range of soils with varying physical and chemical characteristics. The major soils are alluvials, Vertisols and Alfisols, which range in pH from 5 to 7 or more. It is sensitive to salinity and has not been produced on saline soils. It is also susceptible to waterlogging.

DOCUMENTED SPECIES DISTRIBUTION

Native: India, Indonesia, Myanmar, Pakistan

Exotic: Afghanistan, Angola, Argentina, Australia, Bahamas, Bangladesh, Belize, Benin, Bhutan, Brazil, Burkina Faso, Burundi, Cameroon, Colombia, Costa Rica, Cuba, Dominica, El Salvador, Eritrea, Ethiopia, Fiji, Ghana, Grenada, Japan, Kenya, Madagascar, Malawi, Malaysia, Mauritius, Nepal, New Zealand, Philippines, Sri Lanka, Swaziland, Tanzania, Thailand, Uganda, United States of America, Zambia, Zanzibar, Zimbabwe



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 seeds of *C. cajan* can be used as a vegetable. Very young pods are harvested before the seeds are distinct and are cooked in curries or used to make relishes. The dry seeds have several products such as tempe (a traditional Indonesian food prepared by fermenting with a *Rhizopus* mould then soaked, dehulled and cooked legume seeds), and ketchup (pigeonpea sauce, a replacement for soy sauce in Indonesia that is made by fermenting *C. cajan* with *Apergillus oryzae*). *C. cajan* flour (mixed with wheat to improve the protein level of baked products) and clear noodles of a quality higher than that of mung bean are made from dehulled seed. Fresh seeds contain vitamins, especially provitamin A and vitamin B complex. Per a 100 g edible portion, dry seeds contain 7-10.3 g water, 14-30 g protein, 1-9 g fat, 36-65.8 g carbohydrates, 5-9.4 g fibre and 3.8 g ash. The energy content averages 1450 kJ/100 g.

Fodder: *C. cajan* fodder alone may be a bit low in energy. The leaves can provide a good substitute for alfalfa in animal feed formulations, particularly in areas not suitable for alfalfa. The pods are used as cattle feed but are limited by their low protein and high fibre content. They have therefore been used as a roughage source for cattle. *C. cajan* grain has been successfully used for poultry feed. In Hawaii, a mixture of equal quantities of cracked pigeonpea and cracked maize has been proved the best poultry ration.

Apiculture: Honeybees collect nectar from the plant, which is an important honey source. The honey has a distinctive greenish hue in the comb.

Fuel: *C. cajan* sticks are an important household fuel in many areas. The heat value is about 1/2 that of the same weight of coal, and it has several advantages over traditional trees, such as its rapid growth potential, possibility of producing other crops on the same land, and production of a seed crop. Farmers sow it instead of grain because of its wood. Its productivity levels more than make up for the comparatively poor fuel characteristics.

Fibre: On an experimental basis, *C. cajan* has been found to produce a pulp for paper similar to that of hardwoods, and the pulp might be suitable for making good-quality writing and printing paper. The branches and stems can be used for making baskets.

Timber: The wood is used in light construction such as in roofing, wattling on carts, tubular wickerwork lining for wells and baskets.

Medicine: It has many traditional uses as medicine. In Java, for example, the young leaves are applied to sores, herpes and itches.

Other products: *C. cajan* serves as a host for silkworm (in Madagascar) or the lac insect (in northern Bengal and Thailand).

SERVICES

Erosion control: Extensively covering the ground with *C. cajan* prevents soil erosion by wind and water.

Shade or shelter: *C. cajan* is useful as a tall hedge on dry soil and on the bunds of paddy fields. It is often grown as a shade crop, cover crop or windbreak.

Nitrogen fixing: Using the nitrogen-balance method, it has been proved in northern India that long-duration *C. cajan* can fix up to 200 kg N/ha over a 40-week period.

Soil improver: The root system is reported to break plough pans, thus improving soil structure, encouraging infiltration, minimizing sedimentation and smothering weeds. Leaf fall at maturity adds to the organic matter in the soil and provides additional nitrogen. It seems to have special mechanisms to extract phosphorus from black Vertisol soils.

Boundary or barrier or support: In Southeast Asia, *C. cajan* is grown as a support for vanilla.

Intercropping: Due to its hardiness, ability to grow on residual soil moisture, and slow early growth, *C. cajan* is an ideal, non-competitive crop to plant with cereals. In traditional cropping systems, it is mixed with cereals, oil seeds, short-season pulses or cotton, with the cereal as the main crop and *C. cajan* as the bonus crop. In Kenya, it is an important food legume, cultivated commercially for dry seed and as a green vegetable. In Zambia, smallholder farmers generally grow it in their backyards and around the fields of annual crops. In Uganda, it is combined with millet in a cropping system.

TREE MANAGEMENT

For hedgerow intercropping, the hedges should be cut at height of 0.5-1 m when the grain crop is fully mature. The hedges can be cut 2-3 times a year in areas where the dry season lasts 4-6 months. At pod maturity, branches of *C. cajan* are cut at about 0.5 m. Higher levels of pruning can result in higher and unacceptable levels of plant mortality. As a field crop, *C. cajan* may be typified as rather undeveloped; the tall genotypes particularly are cumbersome in cultivation. Weeds must be controlled to alleviate slow initial growth. Wind may bend the plants, but staking is not practised. In intensive cropping of short-duration cultivars, irrigation may be required. *C. cajan*'s response to fertilizers is rarely economic; a phosphate dressing is generally recommended at 20-100 kg/ha.

GERMPLASM MANAGEMENT

Seed storage behaviour is orthodox with no problems for long-term storage under preferred conditions. There are 5000-14 000 seeds/kg.

PESTS AND DISEASES

Because of its long flowering period, damage by pests such as *agromyza* fruitflies and *heliiothis* borers may be compensated for by renewed flushes. Chemical control is cumbersome and expensive in the tree's tall, indeterminate forms. *C. cajan* has more than 100 pathogens. They include fungi, bacteria, viruses, nematodes (cyst nematode, reniform nematode, root-knot nematode) and mycoplasma-like organisms. A disease of economic importance is fusarium wilt (*Fusarium udum*), which is found in Bangladesh, Ghana, Grenada, India, Indonesia, Kenya, Malawi, Mauritius, Nepal and Tanzania. Control measures include cultural practices like rotation with tobacco over several years and breeding for resistance. Sterility mosaic is the most important disease of *C. cajan* in India and Nepal. Others include phytophthora blight and cercospora leafspot.

FURTHER READING

- Akinnifesi FK, Araújo MA, de Moura EG. 1999. Root distribution of *Cajanus cajan* and alley-cropped maize in response to inter-hedgerow spacing: Forest, Farm, and Community Tree Research Reports. 4:64-67.
- Anon. 1986. The useful plants of India. Publications & Information Directorate, CSIR, New Delhi, India.
- Bein E. 1996. Useful trees and shrubs in Eritrea. Regional Soil Conservation Unit (RSCU), Nairobi, Kenya.
- Bekele-Tesemma A, Birnie A, Tengnas B. 1993. Useful trees and shrubs for Ethiopia. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).
- Chirwa TS, Mafongoya PL, Mbewe DN. 2004. Changes in soil properties and their effects on maize productivity following *Sesbania sesban* and *Cajanus cajan* improved fallow systems in eastern Zambia: Biology and Fertility of Soils. 40(1):20-27.
- Cobley L.S & Steele W.M. 1976. An Introduction to the Botany of Tropical Crops. Longman Group Limited.
- Dassanayake MD & Fosberg FR (eds). 1983. A Revised handbook to the Flora of Ceylon. 4:196-487. Amerind Publishing Co. Pvt. Ltd., New Delhi.
- Hong TD, Linington S, Ellis RH. 1996. Seed storage behaviour: a compendium. Handbooks for Genebanks: No. 4. IPGRI.
- ICRAF. 1992. A selection of useful trees and shrubs for Kenya: Notes on their identification, propagation and management for use by farming and pastoral communities. ICRAF.
- Katende AB et al. 1995. Useful trees and shrubs for Uganda. Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).
- Little EL. 1983. Common fuelwood crops. Communi-Tech Association, Morgantown, West Virginia.
- Mbuya LP et al. 1994. Useful trees and shrubs for Tanzania: Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).
- Nene YL et. al. 1990. The pigeon pea. CABI and ICRISAT. University Press, Cambridge.
- Nicholson B.E, Harrison S.G, Masefield G.B & Wallis M. 1969. The Oxford Book of Food Plants. Oxford University Press
- Perry LM. 1980. Medicinal plants of East and South East Asia : attributed properties and uses. MIT Press. South East Asia.
- Rao MR, Mathuva MN. 2000. Legumes for improving maize yields and income in semi-arid Kenya: Agriculture, Ecosystems and Environment. 78:123-137.
- van der Maesen, Somaatmadja S. 1989. Plant Resources of south-east Asia. No. 1: Pulses. Pudoc Scientific Publishers, Wageningen.
- Vandenbeldt R.J. 1988. *Cajanus cajan*: it's more than just a pulse crop. NFT Highlights. Waimanalo, USA.
- Williams R.O & OBE. 1949. The useful and ornamental plants in Zanzibar and Pemba. Zanzibar Protectorate.

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>)