

**LOCAL NAMES**

Bengali (shonpat,shon,ghore sun); English (brown hemp,sunn hemp,sunhemp,Bengal hemp,Bombay hemp,madras hemp,benares hemp,Indian hemp,jubbulpore hemp); Filipino (karay-kagay,putokputukan); French (chenvre indien); Hindi (kharif,sannai sunn); Indonesian (orok-orok lembut); Khmer (kâk'tung); Lao (Sino-Tibetan) (thwax chu:b,po: th'üang); Sanskrit (sana); Tamil (sanal,sannappu); Thai (po-tuang); Vietnamese (luc lac,suc sat)

**BOTANIC DESCRIPTION**

*Crotalaria juncea* is an erect, herbaceous, laxly branched annual, 1-3.5 m tall. The stems are cylindrical and ribbed, pubescent, up to 2 cm in diameter; vegetative parts covered with short, downy hairs. Long, strong taproot, well-developed lateral roots, and multibranched and lobed nodules, up to 2.5 cm in length.

Leaves simple with minute, pointed stipules; petiole entire, short, about 5 mm long with pulvinus blade, linear elliptic to oblong, 4-12 x 0.5-3, bright green.

Inflorescence a lax, terminal raceme, up to 25 cm long; flowers conspicuous, small with 5 hairy sepals, shortly united at base, lobes pointed, with 3 lower sepals united at tips, separating in fruit; petals deep yellow, standard erect, about 2.5 cm in diameter, rounded, sometimes streaked purple on dorsal surface, wings shorter and keel twisted.

Pods cylindrical, 3-6 x 1-2 cm, tomentose, light brown, containing about 6 seeds. Seed heart-shaped, with narrow end strongly incurved, up to 6 mm long, dark brown to black.

The genus name '*Crotalaria*', meaning rattle, is indicative of the noise made by the seeds shaken in the mature pods. The species name was given by Linnaeus because the plant's green, rushlike, scantily leaved branches resemble *Spartium junceaum* L., the Spanish broom of the Mediterranean region.

**BIOLOGY**

*C. juncea* is generally sensitive to photoperiod. Long day lengths favour vegetative growth and reduce seed set, although selections exist that are neutral to day length. Sunn hemp,  $2n = 16$ , is generally reported to be self-incompatible. Cross-pollination is extensive, and self-pollination occurs only after the stigmatic surface has been stimulated by insects or some other means. The wings and keel of the flower are articulated by a ball-and-socket joint. When large bees such as *Xylocopa* spp. and *Vegactile* spp. alight on the wings, they catalyse the ball-and-piston mechanism that forces the stigma with a mass of pollen against the abdomen of the insect. In Brazil, bees have been found the most frequent pollinators, *Xylocopa frontalis* being the most frequent (49.7%), then *X. grisescens* (19.1%). Recently, successful efforts in breeding for self-compatibility have been reported.



Photography courtesy of Western Weeds CD-ROM. A guide to the weeds of Western Australia by B.M.J. Hussey, G.J. Keighery, R.D. Cousens, J. Dodd and S.G. Lloyd. Web version by R. Randall. (Western Weeds)

**ECOLOGY**

Although generally considered a tropical or subtropical crop, sunn hemp is drought resistant and is widely adaptable to different soil types. Its tolerance to salt and frost is low.

**BIOPHYSICAL LIMITS**

Mean annual temperature: 9-30 deg. C

Mean annual rainfall: 170-1 500 mm

Altitude: 0-300 m

Soil type: For fibre production, light, loamy well-drained soils are preferred; on low-lying or clay soils it achieves vigorous growth, but the bast fibre is coarser and yields are lower. PH of 5-8.4 is a suitable range.

**DOCUMENTED SPECIES DISTRIBUTION**

Native: Australia, India

Exotic: Bangladesh, Botswana, Brazil, Cambodia, Central African Republic, Colombia, Ethiopia, Indonesia, Japan, Kenya, Laos, Lesotho, Mauritania, Myanmar, Namibia, Niger, Pakistan, Philippines, Russian Federation, Rwanda, South Africa, Sri Lanka, Swaziland, Taiwan, Province of China, Thailand, Togo, Trinidad and Tobago, Uganda, US, Vietnam, 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**

**Fodder:** *C. juncea* is widely used as forage in Sri Lanka and southern Africa. The presence of compounds that cause unpalatability, which are poisonous under some conditions, is typical of the genus *Crotalaria*. Seeds may contain about 35-40% protein; stems are about 40% fibre. Leaves and stems are dried, as animals do not eat *C. juncea* when it is green. Sheep will not suffer any adverse effects if forced to eat dried forage, but they will suffer from toxicity if fed large quantities of seed. *C. juncea* should not be fed to horses, and intake of hay by cattle should be restricted to about 10% of their diet.

**Fibre:** The major significance of sunn hemp lies in its valuable fibre, which is extracted from the bark and used to make twine and cord, canvas and fishing nets, and paper and pulp. Sunn hemp fibre has greater tensile strength and is more durable under exposure than jute. It is not as strong as hemp (*Cannabis sativa*).

The 3 main properties that make sunn hemp an excellent candidate for paper-making are 1) good yields of bleachable sulphate pulps, 2) pulp strength properties that are equal to or greater than those of mixed southern hardwood pulp, and 3) length-to-width ratio of bast fibre that is greater than that of wood fibres. Stems are composed of 2 fibres--the bast and the woody core. Bast fibres, located in the outer bark, are much longer than the core fibres, but the 2 fibre widths are similar. The proportion of bark in the total stalk by dry weight ranges from 15% to 20%.

Sunn hemp fibre is used in twine, rug yarn, cigarette and tissue papers, fishnets, sacking, canvas and cordage. Fibre is stronger when wet; it is fairly resistant to mildew, moisture and microorganisms in salt water.

**Poison:** The seeds of many *Crotalaria* species contain toxic pyrrolizidine alkaloids. Trichodesmine is the principal toxic alkaloid in *C. juncea*. The seeds are reported to contain trypsin inhibitors; they are said to be poisonous to cattle, and they can poison both horses and pigs.

**Medicine:** The seeds are said to purify the blood and are used to treat impetigo and psoriasis.

**SERVICES**

**Nitrogen fixing:** *C. juncea* is capable of fixing atmospheric nitrogen.

**Soil improver:** *C. juncea* is widely grown in the tropics as a green manure. Total green matter yield averages 18-27 t/ha; forage yield, 5-19 t/ha. As well as producing high organic-matter yields, it can reduce the build-up of root-knot nematode populations.

**Intercropping:** Often grown as a cover crop and in rotation with tobacco, vegetables, dry grains, rice, corn, cotton, sugarcane, pineapples, coffee, and orchard crops.

**TREE MANAGEMENT**

When grown for fibre, the plants are usually harvested at the flowering stage or when the stems turn yellow. For seed production, the crop is harvested when the seeds are ripe; fibre is extracted from the stems afterwards. There are no significant differences in strength and quality of fibre obtained from plants retted at flowering time and those retted when seeds are fully mature. The retting period depends on water temperature, locality, time of year, weather conditions, depth and source of water, thickness of stalks, and quantity of straw in relation to volume of water. Cut straw with a yellowish tinge requires 10 days to 3 weeks to bleach out sufficiently to have fibre of a satisfactory colour. Stems cut while green will bleach out when exposed directly to the sun but have to be turned at least twice.

Land should be prepared well before planting for fibre production. Although *C. juncea* generally suppresses weed populations due to the dense shade of its canopy, early-season weed control improves fibre yield. Reports on fertilization requirements vary, but addition of phosphorus is generally recommended for soils low in phosphorus.

When grown for forage, *C. juncea* can be harvested 4 times, starting 6-8 weeks after sowing and then every 4 weeks. It should be cut for hay or ploughed in for green manure in the early flowering stage when it is 1.5-2.5 months old.

**GERMPLASM MANAGEMENT**

Seed weight is highly variable, depending on cultivar and environment; it can range from 18 000 to 33 000 seeds/kg.

**PESTS AND DISEASES**

Damage from insects is more severe if crops are planted in the same area for more than 3 consecutive years. The 2 most important and serious insect pests are the sunn hemp moth (*Utethesia pulchella*) and the stem borer (*Enarmonia pseudonectis*).

Major insect pests in the USA are the lima bean pod borer (*Etiella zinckenella*) and the bella moth (*Utetheisa bella*). In Florida, these insect pests were reported to attack the fruiting pods, with little to no seed being produced. In India, the 2 major insect pests are *U. pulchella*, which feeds on the leaves and seed pods, and the top-shoot borer (*Laspeyresia pseudonectis*), which bores into the apical tip of the plant, causing excessive branching and stops growth.

Other insect pests that are reported to periodically attack *C. juncea* are the leaf-feeding caterpillars *Argina cribraria* and *A. syringa*. Additional stem- or shootborer species include *Laspeyresia tricenta*, *Cymotricha tetraschema* and *Selinas monotropa*. Beetles of the genus *Exora* could cause serious defoliation. Black beetles are a serious pest in Zimbabwe.

*C. juncea* is attacked by many fungi, nematodes, bacteria and viruses. A serious disease in India is anthracnose, caused by *Colletotrichum curvatum*. In South America, the fungus *Ceratocystis fimbriata* has been reported to cause a wilt disease.

**FURTHER READNG**

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**SUGGESTED CITATION**

Orwa C, Mutua A , Kindt R , Jamnadass R, Simons A. 2009. Agroforestry Database:a tree reference and selection guide version 4.0 (<http://www.worldagroforestry.org/af/treedb/>)