

Calliandra calothyrsus

Calliandra calothyrsus is a small multipurpose legume tree growing in the tropics.

of east Africa as well as in Australia, Hawaii, Brazil and Bolivia.^{[6][7]}

1 Basic Information

Calliandra Calothyrsus is a small tree or a large shrub.^[1] It is usually 4–6 m high but might reach a height of 12 m under favourable conditions.^[2] The stems are quite small with a maximum base diameter of about 30 cm, the bark is blackish-brown.^[3] The canopy is dense with alternate, petiolate, bipinnately compound leaves of 10–28 cm lengths,^[1] which are folding together at night.^[2] Calliandra calothyrsus has both superficial and deep-growing roots.^[2] While the above-ground parts are only short lived, the roots are able to sprout up to 20 years.^[2]

The flowers are subterminal inflorescences with numerous long, hair-like purple or red stamens.^[2] Flowering starts 3–6 months after planting.^[2] The fruits consist of pods (8–11 cm long and 12 mm wide) that contain 3–15 seeds.^[2] Seed mature 2 months after pollination and can be planted immediately as they have no dormancy period.^[2]

1.1 Systematics

The genus Calliandra belongs to the family Fabaceae (Leguminosae), subfamily Mimosoideae and tribe Ingae. Calliandra is a large genus with about 145 species, mainly from South and North America but also from Madagascar, India and Africa.^[4] Calliandra Calothyrsus is one of seven species in a subgroup of the genus, the Racemose. Calliandra calothyrsus was described by Meissner (1848). The names Calliandra confusa and Calliandra similis can be used synonymously.^[5]

1.2 Origin and Regions of Cultivation

Calliandra Callothyrsus is native to the humid and sub-humid areas of Central America and Mexico. There it can be found from the western Pacific coast of Mexico to Panama.^[6] But people most probably haven't been cultivating or studying it there.^[2] Calliandra has been introduced to Java in 1936 and spread from there over the Indonesian Archipelago and to other parts of southeast Asia.^[7] Nowadays it can also be found in other parts of the tropics, mainly in Uganda, Rwanda and other parts

1.3 Environmental Requirements

1.3.1 Temperature and Altitude

Calliandra calothyrsus grows in regions with mean monthly minimum temperatures of 18–24 °C and mean monthly maximum temperatures of 24–28 °C.^[6] It can be found in a wide range of altitudes but seems to grow best at altitudes of 250–1300 m asl.^[6] However it can naturally reach an altitude of 1800 m asl in Guatemala and even grows well if planted at 2000 m asl as it was done in Indonesia and Kenya. At these altitudes Calliandra calothyrsus has quite some cool tolerance for a tropical species but it is not tolerant to frost.^{[6][7]}

1.3.2 Precipitation

Calliandra calothyrsus tolerates annual rainfalls of 700–4000 mm.^[8] It usually grows in wet tropical forests or in seasonally dry forests with a dry season of 4–7 months.^[8] Calliandra calothyrsus is not very drought tolerant^[6] and will die back under sever droughts. However it is recovering in most cases after the onset of the rainy season.^[7] Calliandra calothyrsus is semi-deciduous in regions with long dry seasons whereas it is evergreen in humid climates.^[6]

1.3.3 Soil

Calliandra calothyrsus is adapted to different types of soils. The best growing conditions are on light textured, slightly acidic soils but it is also well adapted to acidic soils with poor soil fertility and is able to grow on infertile and compacted soils.^[9]

2 Production

2.1 Seed Production

The seed production is during the dry season from June to September. After collecting, drying and storing of the seeds they can germinate without treatment,^[2] but a quicker germination is achieved by soaking the seeds in cold water for 48 hours.^[6] The seeds could be stored for

1–2 years,^[10] but since *Calliandra calothyrsus* sets fruits continuously there is no need to store.^[2]

2.2 Nursery Practices

Otherwise seedlings can be produced by sowing seeds in a nursery bed and allowing them to grow until they are 20 to 50 cm high with a root collar diameter of 0.5 to 1.0 cm. At this stage they can be replanted. Another method is to produce stumps. In this case the seedlings can grow for four months until they reach a height of 75 to 100 cm subsequently they are top- and root-pruned to about 30 to 20 cm. Stumps are very useful for interplanting among other trees or for a better establishment on steep slopes.^[2]

2.3 Cultivation

Plantation of *Calliandra calothyrsus* can be either done by direct seeding or by seedlings. For direct seeding the rows should be free of weeds and the ground should be roughly cultivated.^[2] The seeds should be sown at 1 to 3 cm depth.^[6] In case of planting seedlings the complete area or at least strips or spots have to be cleared.^[2] Plantation of seedlings is done at the beginning of the rainy season and an initial treatment of fertilizer can have a positive effect on the seedlings.^[2] The early growth is slow but after the mycorrhizal infection the plant grows up to 3.5m in 6 months.^[9] Because of the slow early growth weeding is necessary in the first year but afterwards the canopy closes and weed is no longer problematic. Within the first year *Calliandra* flowers and bear fruits and after 12 months the plants can be 3 to 5 m tall and 5 cm in diameter at stump height. At this stage the plant has the optimal size for the use of firewood. Harvesting is done at the end of the dry season and for a faster resprouting the cutting is done 20 to 50 cm above the ground.^[2]

2.4 Pests and Diseases

Only minor damages are caused by pests on *Calliandra calothyrsus*. Seedlings might be attacked by the teak sapling borer (*Sahyadrassus malabaricus*). Further *Pachnoda ephippiata* might feed on flowers, fruits and foliage, what causes floral abortion and poor seed production. Fungal attacks can cause serious damages on *Calliandra calothyrsus* when the plants are cut back too low prior to rainfall or during the wet season.^[11]

3 Product and Uses

3.1 Soil Improvement

Calliandra calothyrsus is a small legume tree able to fix nitrogen from the atmosphere,^[2] which has a positive effect

on the nitrogen content in the soil.^[7] *Calliandra calothyrsus* can be used in crop rotation with sugar cane^[7] or with other crops.^[12] *Calliandra calothyrsus* is used for example as stake for other crop species, such as climbing beans.^[13] *Calliandra calothyrsus* also provides shade for seedlings of plantations species, like Damar for example.^[2]

3.2 Reforestation

Calliandra calothyrsus is a fast growing tree^[2] that has a potential for reforestation in the Tropics.^[7] It prevents soil erosion encountered in deforested areas.^[2] Its rooting system is composed by deep roots as well as numerous lateral roots that enhance a good soil structure.^[2]

3.3 Animal Fodder

Calliandra leaves and young shoots provide a high valuable protein source for animals.^[8] It is already used widely in the Tropics: in Indonesia for example for the dairy cattle.^[8] Normal supplementation rate of *Calliandra calothyrsus* is around 20-40%.^[6] In Uganda, *Calliandra calothyrsus* is mostly mixed with other fodder for cows (grasses, tree species...)^[13] *Calliandra calothyrsus* leaves do not contain any toxic compounds^[8] but high condensed tannins concentrations,^[7] which could limit the digestibility for ruminants.^[8] It has been shown that moderate condensed tannin concentrations (2-4% dry matter) can enhance the protein metabolism for ruminants.^[14] However, high tannin levels up to 11% have a negative effect on the digestibility mechanisms.^[7] Non-ruminants like monogastrics seem to have more problems to metabolize the amount of tannins in *Calliandra calothyrsus*.^[13] *Calliandra calothyrsus* should not be used in grazing regions only, because the risk that animals destroy the tree bark is high, which leads to a high tree mortality.^[6] Animals should eat freshly cut *Calliandra* leaves^[6] that were cut between 0 and 1 meter.^[13] Apparently, dry leaves seem to be less palatable to animals.^[8] Some beneficial effects of using *Calliandra calothyrsus* as fodder have been observed in Uganda, where farmers noticed an increase in milk production.^[13] It is a cheap fodder that also increases production and fat content of milk.^[13] The crude protein content is 20-25% of dry matter.^[13] *Calliandra calothyrsus* has a yield of 7-10 t/ha/year of dry matter in Indonesia.^[8]

3.4 Firewood

Calliandra calothyrsus is a valuable wood source to poor populations that still rely on firewood as energy source.^[2] Its fast growing rate enables a quick fuelwood production.^[2] The drying process is faster because *Calliandra calothyrsus* has already lower moisture content (9-12%) than other tree species (13,5%).^[7] The wood can already be used after 6 days.^[2] Its calorific value is around

4720 kcal/kg.^[7] The yield is long-term high: Calliandra calothyrsus can be harvested during 10 to 20 years.^[7]

4 Perspectives

Calliandra calothyrsus might have a huge potential use in the Tropics which are the regions where problems linked to agricultural products are growing. As most of the tropical soils are losing their fertility, planting Calliandra calothyrsus is a way to improve soil fertility and stabilize the soil structure. Agricultural systems such as intercropping with Calliandra calothyrsus are promising and are a way to deal with deforestation issues. Despite all its benefits, Calliandra calothyrsus could become an invasive plant if it's not well managed. Moreover, pest and diseases have recently started to appear in East Africa.^[6] Nevertheless, Calliandra calothyrsus has a promising future in the Tropics.

5 References

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6.1 Text

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