Sesbania grandiflora

Scientific name
Sesbania grandiflora (L.) Pers.

Synonyms
Aeschynomene grandiflora (L.) L.
Agati grandiflora (L.) Desv.
Robinia grandiflora L.
Sesban grandiflorus Poir.

Family/tribe

Common names
agati, agusta, bagphal, bak, bake (Bengali); pwa valet, pwa valye (Creole Patois); agathi, agati sesbania, August flower, Australian cokrkwood tree, flamingo bill, grandiflora, sesban, swamp pea, tiger tongue, scarlet wistaria-tree, vegetable-hummingbird, West Indian pea, white dragon tree (English); gauai-gauai, katuday, katurai, pan (Filipino); colbri vegetal, fagotier, fleur papillon, papillon, pois valette, pois vallier, pois valliere (French); agasti, bak, basma, basna, chogache, hatiya (Hindi); toroy, turi, tuwi (Indonesian); ângkiëdèi (Khmer); kh'ê: khaw (Lao (Sino-Tibetan)); kacang turi, petai belalang, sesban, sesban getih (Malay); agasti (Nepali); agathi, agati, anari (Sanskrit); kathuru, murunga (Sinhala); baculo, cresta de gallo, gallito, paloma, pico de flamenco, zapaton blanco (Spanish); agathi, agati, peragathi (Tamil); kae-ban, khae, ton kae (Thai); So dua (Vietnamese).

Morphological description
An open branching tree up to 15 m tall and 30 cm in diameter. Roots are normally heavily nodulated with large nodules. The tree can develop floating roots and aerenchyma tissue. Stems tomentose, unarmed. Leaf pinnately compound, up to 30 cm long including a petiole 7-15 mm long; the rachis slightly pubescent or glabrous; leaflets 20-50, in pairs opposite to alternate on the same leaf, oblong to elliptical, 12-44 mm x 5-15 mm, rounded to obtuse to slightly emarginate at the apex, glabrous or sparsely pubescent on both surfaces. Stipels filiform, 0.75-1 mm long, pubescent, persistent, stipules broadly lanceolate, 8 mm long, early deciduous.

Raceme axillary, 2-4 flowered, rachis up to 65 mm long; peduncle 15-35 mm long, tomentose; pedicels 15-18 mm long, pubescent; bracts lanceolate, 3-6 mm long, early deciduous; flowers white, yellowish, rose-pink or red; calyx 15-22 mm long, closed in young buds, splitting or breaking at anthesis, the basal part persistent in the fruit; standard up to 10.5 x 8 cm, no appendages at the claw; wings up to 10.5 x 3 cm without a basal tooth, staminal tube 10-12 cm long, curved for most of its length; ovary and style glabrous.

Pod linear to slightly falcate, 20-60 x 6-9 mm with broad sutures, 15-50 seeded, septa 7.5-10 mm apart, glabrous, hanging vertically, indehiscent. Seed subreniform, 6.5 x 5 mm x 2.5-3 mm, dark brown. Seed weight is 17,000-30,000 seeds/kg.

Distribution
Native to:
Tropical Asia including, India, Indonesia, Malaysia, Myanmar and Philippines, with possibly Indonesia as the centre of diversity. Closely related to the Australian species, S. formosa.

Widespread exotic distribution: northern Australia (possibly native), Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Cuba, Djibouti, Dominican Republic, Eritrea, Ethiopia, Gambia, Ghana, Guadeloupe, Guinea, Guinea-Bissau, Haiti, Kenya, Liberia, Mali, Martinique, Mauritania, Mauritius, Mexico, Nepal, Niger, Nigeria, Puerto Rico, Senegal, Sierra Leone, Somalia, South Africa, Tanzania, Togo, Uganda, United States of America.

Has been cultivated in West Africa for at least 140 years.

Uses/applications
Valued as a fodder throughout Indonesia, particularly for dry season feeding of cattle and goats. Commonly grown on paddy bunds, and around gardens or cropping fields for its nitrogen contribution. The sparse canopy of S. grandiflora casts relatively little shade, hence its suitability close to sun-loving crops and gardens. S. grandiflora grows fast enough to be used as an annual green manure crop. The leaves, seed pods and flowers are used as human food in southeast Asia.

The light density wood of S. grandiflora makes poor firewood and is not durable as a timber, however it can be used for low quality pulp. Poles are used for light construction but have limited durability. Used as a shade crop and as a support for climbing crops. Also used as a component of windbreaks.

Ecology
Soil requirements
Tolerant of a wide range of soils including soils that are alkaline, poorly drained, saline, or of low fertility. S. grandiflora has some tolerance of acid-soils down to pH 4.5. It is well adapted to heavy clay soils.

Moisture
Best adapted to regions with annual rainfall of 2,000-4,000 mm, but has been grown successfully in semi-arid areas with 800 mm annual rainfall and up to 9 months dry season. Tolerant of flooding over short periods.

**Temperature**

Only adapted to the lowland tropics up to 800 m, occasionally to 1,000 m asl environments with mean annual temperatures of 22-30ºC. *S. grandiflora* is frost sensitive and intolerant of extended periods of cool temperatures.

**Light**

Poor shade tolerance, less than that of *S. sesban*. Its rapid early growth and erect habit usually enables *S. grandiflora* to access sunlight by overtopping neighbouring plants.

**Reproductive development**

The large hermaphroditic flowers are pollinated by birds. *S. grandiflora* is able to produce ripe pods 9 months after planting.

**Defoliation**

Intolerant of severe and regular pruning when young. In Lombok, Indonesia, side branches are cut for feed, leaving the trees to develop tall poles. After the tree has reached a height of 3 m or more, the leader can be cut back above 1.5 m height. In Timor, Indonesia, large trees are heavily pruned during the long dry season without significant mortality. Cutting regularly (5 times a year) to form a low hedgerow (1 m tall) resulted in almost 100% mortality in an agronomic trial in northeast Thailand. For this reason *S. grandiflora* often appears poorly productive in agronomic trials. Low hedgerows can be achieved by regular replanting from seed. The tree has a potential lifespan of 20 years.

**Fire**

Tolerates low to medium intensity grass fires in Eastern Indonesia.

**Agronomy**

Guidelines for the establishment and management of sown pastures.

**Establishment**

Establishes rapidly from seed or by vegetative propagation from stem and branch cuttings. Scarification may improve uniformity of establishment but is not considered essential. Generally must faster to establish compared to other common tree legumes (*Leucaena, Gliricidia, Calliandra*). Commonly planted as individual trees or in rows, spaced 1-2 m apart along fence lines, field borders and the bunds of rice paddies. In fertile sites will attain a height of 5-6 m in 9 months. Height increments are greatly reduced in the second year of growth. Can be planted at high densities (up to 3,000 stems/ha) to produce pole timber, or sparsely planted to produce dry-season forage and fuelwood.

**Fertiliser**

Tolerant of low fertility soils so that no fertiliser is generally required.

**Compatibility (with other species)**

Not generally directly grazed by livestock as high plant mortality will occur. Combined in grazed paddocks as mature trees out of browse height, or as cut-and-carry forage integrated into cropping systems.

**Companion species**

Grasses: Has been grown in association with guinea grass (*Panicum maximum*). Its sparse canopy and erect habit also enables *S. grandiflora* to be grown on crop margins with little reduction in sunlight to the crop.

**Pests and diseases**

*S. grandiflora* is susceptible to severe pest attacks from leaf webbers, leaf feeders and stem borers. The stem borer *Azygophleps scalaris* has caused occasional damage in India. Larvae of the seed chalcid *Bruchophagus mellipes* infest and damage seed. Highly susceptible to the root-knot nematode *Melodogyne incognita*. Susceptible to grey leaf spot *Pseudocercospora sesbaniae*, with variable susceptibility depending on provenance (accessions from Malabar more tolerant than those from the Southern Ghats in India). Sesbania mosaic virus is reported in India and is spread from infected growing trees.

**Ability to spread**

Moderate, from seed.

**Weed potential**

Seeds freely, but seed is short-lived, deteriorating rapidly in viability from 1-2 years onwards without low humidity and low temperature storage. Open thickets occur in some range areas of eastern Indonesia. Moderate weed potential. Does not become a weed in managed agro-ecosystems.
Feeding value

Nutritive value
Contains 25-30% crude protein. Supplementation with *S. grandiflora* of goats fed guinea grass hay increased intake by 25% and supported a positive N balance. *In sacco* digestibility was 75% in 12 hours. Other *in vitro* and *in sacco* studies report the very high forage quality of *S. grandiflora*.

Palatability/acceptability
Highly palatable to ruminant livestock. Also generally well accepted by monogastrics.

Toxicity
Seeds contain a toxin poisonous to fish. Contains low quantities of condensed tannins. Also contains canavanine, the nutritional implications of which are unknown.

Production potential

Dry matter
An annual yield of 27 kg of green leaf/tree was achieved by harvesting side branches. A green manure yield of 55 t/ha green material in 6.5 months was achieved in Java. Wood yields of 20-25 m³/ha/year are achieved in commercial plantations in Indonesia.

Animal production
No long-term animal production studies have been reported, but *S. grandiflora* is a major component of ruminant diets in eastern Indonesia where it may comprise up to 70% of total forage allowance during the dry season. Anecdotal reports of high liveweight gains in cattle are common. In India, milk yield was increased by 8% (9.2-9.9 l/day) when cattle were fed 5 kg fresh leaf/day.

In Western Samoa, goats failed to gain weight when supplemented with *S. grandiflora*, although the reasons for this poor result were not identified. The authors suggested that supplementation with *S. grandiflora* should be limited to 30% of total feed on the basis of this experiment.

Poor weight gains in chickens has led to the recommendation that supplementation of poultry feeds with *S. grandiflora* should be limited to 2% of total ration.

Genetics/breeding
Little or no breeding work has been undertaken. Significant variation exists in flowering time, with early flowering varieties being preferred (and progressively selected for by local farmers) in Lombok, Indonesia where flowers are an important food crop. Later flowering varieties predominate in West Timor, Indonesia where the species is primarily used as a cut-and-carry cattle feed.

Seed production
Seeds into lengthening days with early and late varieties being preferred in different locations. Seed is immediately germinable without requirements for scarification and deteriorates rapidly in viability.

Herbicide effects
No information available.

Strengths
- Rapid establishment from seed.
- Tolerant of a wide range of soil types and rainfall environments.
- High palatability and forage quality.

Limitations
- Intolerant of cool temperatures and frost.
- Low to moderate tolerance of regular defoliation.
- Unsuitable to direct grazing by ruminants.
- Limited or no potential as a forage for non-ruminants.

Other comments
Intolerant of strong winds which may break the stem or branches. Considered to be a poor quality fuelwood as it smokes when burn and deteriorates in storage.

Selected references


Flower and pinnate foliage.
Foliage, flowers, pods and seeds.
Young plants establish rapidly.
A mature flowering tree.

Used as a hedgerow in Lombok, Indonesia (top) and as a pruned hedge (below).
Row planting showing long hanging pods.
Growing on paddy bunds.


**Internet links**
http://www.hort.purdue.edu/newcrop/duke_energy/Sesbania_grandiflora.html
http://www.winrock.org/forestry/factpub/factsh/GRANFLO2.TXT
http://www.worldagroforestry.org/Sites/TreeDBS/AFT/SpeciesInfo.cfm?SpID=1519

**Cultivars**

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<thead>
<tr>
<th>Cultivars</th>
<th>Country/date released</th>
<th>Details</th>
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<tbody>
<tr>
<td>No cultivars of <em>S. grandiflora</em> have been formally released.</td>
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**Promising accessions**

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<th>Promising accessions</th>
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<tr>
<td>Few accession details are given in the research literature examining <em>S. grandiflora</em>. Landrace details in the literature reveal significant variability in flowering time and disease resistance. Several authors have suggested that the genetic and agronomic diversity in <em>S. grandiflora</em> deserves further attention.</td>
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From: 't Mannetje, L. and Jones, R.M. (1992)
Plant Resources of South-East Asia No. 4.
Forages (Pudoc Scientific Publishers,
Wageningen, the Netherlands). © Prosea Foundation.