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Sesbania grandiflora (L.) Poiret: A Potential Agroforestry Tree Species

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Agast is an important agroforestry tree species, which is widely distributed in Tropical Asia. Being a N_2 fixing tree species it plays most important role in improving soil properties. It valued as an important fodder tree, particularly for dry season feeding of cattle and goats. The flowers and pods has high nutritive value and widely used as a food in Southeast Asia. It has sparse canopy which is an important character of agroforestry tree species. It increases production potential of associate crop through nutrient cycling and reducing competition for resources. It is also grown with grasses such as *Panicum maximum* to reduce erosion losses and improving wastelands.

Introduction

Sesbania grandiflora L. (Agast) is well known small, loosely branching, legume plant native to the Tropical Asia including, India, Indonesia, Malaysia, Myanmar and Philippines. It belongs to leguminosae; papilionoideae family. It is closely related to the *S. formosa*, Australian species. Widely distributed in 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. It has been cultivated in West Africa at least 140 years ago.

Agast grows up to 8-15m tall and 25-30cm in diameter; stems tomentose, unarmed; roots normally heavily nodulated with large nodules; the tree can develop floating roots. Leaves alternate and compound; pinnate, 15-30cm long with 12-20 pairs of oblong, rounded leaflets, 3-4cm long and about 1cm wide; leaves borne only on terminal ends of branches; leaves turn bright yellow before shedding. Flower clusters hanging at leaf base have 2-5 large or giant flowers; pink, red or white, pea like, 5-10cm in length, curved, about 3cm wide before opening. Pods long and narrow, hanging down 30-50cm by 8mm; septate, wide, flat, with swollen margins and about 15-40 pale-coloured seeds; seed is beanlike, elliptical, red brown, 6-8 in a pod, 3.5mm, each weighting 1g. It tolerates low to medium intensity grass fires and intolerant of severe and regular pruning when young. The tree has a potential lifespan of 20 years. After the tree has reached a height of 3m or more, the leader can be cut back above 1.5m height (FAO; Evans, 2001; Evans and Rotar, 1987; Singh, 1995; MacDicken, 1994).

Figure: Leaves, flowers and pods of agast tree species

Potential in agroforestry

Agast valued as an important fodder tree, particularly for dry season feeding of cattle and goats. 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. It has very high forage quality and it contains 25-30% crude protein. Supplementation with Agast of goats fed guinea grass hay increased intake by 25% and supported a positive N balance. It is highly palatable to ruminant livestock. Seeds contain a toxin poisonous to fish. It also contains low quantities of condensed tannins and canavanine, the nutritional implications of canavanine is unknown. The leaves, seed pods and giant flowers are used as human food in Southeast Asia. The antibacterial activity of *Sesbania grandiflora* extracts was reported by Anantaworasakul *et al.* (2011).

Agast is mostly preferred for planning at field boundaries, hedge row intercropping or alley cropping and in home gardens. It does not become a weed in managed agro-ecosystems; however it has moderate weed potential. Agast grows fast enough to be used as an annual green manure crop. On the fields, it also acts as windbreak. It is excellent nitrogen fixing tree species for providing soil improvement through nutrient cycling and nutrient addition. It nodulates only with Rhizobium (*Sensu stricto*), a fast growing (*i.e.,* rapidly-multiplying) strains. Commonly grown on paddy bunds, and around gardens or cropping fields for its nitrogen contribution. Used as a shade crop and as a support for climbing crops. However, it grows with betel and paper vines for support and shelter. Its sparse canopy and erect habit it affects little on crops grown as it show more supplementary effect than competition for resources. The sparse canopy of agast casts relatively little shade, hence its suitability close to sun-loving crops and gardens. It may grow along with grass species for improving eroded, waterlogged wastelands and acid soils. It has been grown successfully in association with guinea (*Panicum maximum*) grass (Nair, 1993; Desai and Prabhakar, 2001).

The light density wood of agast makes poor firewood and is not durable as a timber; however it can be used for low quality pulp. It is also used for preparation of charcoal for gunpowder. Poles are used for light construction but have limited durability (FAO; Singh, 1995; MacDicken, 1994; Nair, 1993).

Production potential

An annual yield of 27kg of green leaf/tree was achieved by harvesting side branches. In Java it produces 55 t/ha of green material in 6.5 months. Wood yields of 20-25 m^3/ha/year are achieved in commercial plantations in Indonesia.

No long-term animal production studies have been reported, but agast 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 live weight 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.

Poor weight gains in chickens has led to the recommendation that supplementation of poultry feeds with agast should be limited to 2% of total ration (FAO; Singh, 1995; Nair, 1993).

Adoption, tolerance and sensitive to adverse condition

Agast may grow in alkaline, poorly drained, saline, low fertility soils and also has some tolerance of acid-soils down to pH 4.5. It is well adapted to heavy clay soils.

It is best adapted to regions with annual rainfall of 2,000-4,000mm and also grown successfully in semi-arid areas with 800mm annual rainfall and up to 9 months dry season. It is adapted to the lowland tropics up to 800m, occasionally to 1,000m asl environments with mean annual temperatures of 22-30ºC. It is frost sensitive and intolerant of extended periods of cool temperatures. Poor shade tolerance, less than that of *S. sesban* (FAO; Singh, 1995).

Propagation and establishment

Agast is mainly propagated by seeds. The large hermaphroditic flowers are pollinated by birds. It is able to produce ripe pods nine months after planting. It may easily propagated by stem and branch hardwood cuttings.

The seeds are collected from the best trees in May and sown soon for raising of seedlings in nursery. Scarification may improve uniformity of establishment but is not considered essential. The viability of seed is about six months and 1 kg seed contains about 16000 seeds. The seeds are sown during May- June in polythene bags or in nursery beds. The seeds are germinated in a week. The seedlings become ready for transplanting after 30-45 days of sowing. The seedlings are planted in $30cm^3$ size pits at different spacing.

Generally it is much faster to establish compared to other common tree legumes (*Leucaena*, *Gliricidia* and *Calliandra*). Commonly planted as individual trees or in rows, spaced 1-2m apart along fence lines, field borders and the bunds of rice paddies. In fertile sites will attain a height of 5-6m in nine 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 fuel wood (FAO; Singh, 1995).

Pests and diseases

Agast 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. It is highly susceptible to the root-knot nematode *Melodogyne incognita* and 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 (FAO; Singh, 1995).

Conclusion

Agast tree species is excellent leguminous nitrogen fixing tree species. It serve as best source of green manure as well. However, having sparse canopy it cultivate with betel and paper vines for support and shelter. It causes supplementary effect on associated agricultural crop with reduction in competition for resources (light, moisture and nutrients). It is good source of fodder, food, fuel wood and round wood. Overall, agast has the potential to combat food security problem, energy crisis and problems in sustainable development.

References

Anantaworasakul P, Klayraung S and Okonogi S. 2011. Antibacterial activities of *Sesbania grandiflora* extracts. *Drug Discoveries and Therapeutics*. 5(1): 12-17.

Desai BK and Prabhakar AS. 2001. Nutrient contributions of hedge row prunings of *Sesbania grandiflora* (L). Poir. in alley cropping system-growth parameter of adjacent maize and groungnut. *Karnataka J. Agri. Sci.* 14 (4): 888-893.

Evans DO. 2001. *Sesbania grandiflora*: NFT for beauty, food, fodder and soil improvement. In: Roshetko JM (ed.). Agroforestry Species and Technologies. Winrock International, Morilton, USA. Pp 155-156.

Evans DO and Rotar PP. 1987. *Sesbania* in Agriculture. Westview Tropical Agriculture Series No. 8. Westview Press, Boulder, Co, USA.

Gill AS. 1986. A fuel/fodder production system using *Sesbania grandiflora*. Nitrogen Fixing Tree Research Reports. 4: 14-15.

MacDicken GK. 1994. Selection and management of nitrogen fixing trees. Winrock International, and Bangkok: FAO.

Nair PKR. 1993. An introduction to agroforestry. Kluwer Academic Publishers. Netherlands. 499p.

Singh SP. 1995. Favourite agroforestry trees. Agrotech Publishing Academy. Udaipur. Pp 275.

Important links

http://www.hort.purdue.edu/newcrop/duke_energy/Sesbania_grandiflora.html
http://www.winrock.org/forestry/factpub/factsh/GRANFLO2.TXT
http://www.fao.org/ag/AGP/AGPC/doc/Gbase/data/pf000171.htm
http://www.fao.org/ag/AGA/AGAP/FRG/afris/Data/282.HTM
http://www.worldagroforestry.org/Sites/TreeDBS/AFT/SpeciesInfo.cfm?SpID=1519
http://www.tropicalforages.info/key/Forages/Media/Html/Sesbania_grandiflora.htm
http://cals.arizona.edu/fps/sites/cals.arizona.edu.fps/files/cotw/Sesbenia.pdf
http://www.worldagroforestry.org/treedb2/AFTPDFS/Sesbania_grandiflora.pdf
http://www.fao.org/ag/agp/AGPC/doc/Publicat/Gutt-shel/x5556e08.htm
http://www.agroforestry.net.au/edit/pdfs/Design%20Principles%20Fodder%20Chapter%205.pdf