Conservation and Sustainable Use of Genetic Resources
of Priority Food Tree Species in sub-Saharan Africa

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Parkia biglobosa

African locust bean

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Leaves, flowers and pods of African locust bean

Common name
African locust bean (English)

Néré, nété, mimosa pourpre, arbre à farine (French)

Scientific name
Parkia biglobosa (Jacq.) R.Br. ex G.Don

Synonyms
Parkia africana R. Br.; *Parkia clappertoniana* Keay; *Parkia filicoidea* var. *glauca* Baker; *Parkia intermedia* Oliver; *Mimosa biglobosa* Jacq.; *Inga biglobosa* (Jacq.) Willd; *Inga faeculifera* Desv.

Family
Mimosoïdeae

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This leaflet highlights the nutritional and socio-economic potential of African locust bean and provides information to assist those working with the species. The focus is on conserving genetic diversity and promoting sustainable use of African locust bean. The leaflet presents a synthesis of current knowledge about the species. The recommendations provided should be regarded as a starting point, to be further developed according to local or regional conditions. These guidelines will be updated as new information becomes available.

Socio-cultural group	Country	Vernacular name
Mossi	Burkina Faso	Zaanga
Jula	Burkina Faso	Néré
Bemoka	Ghana	Du
Dagt	Ghana	Dua
Bambara	Mali	Néré
Hausa	Nigeria	Dorawa
Yoruba	Nigeria	Igba, Irugba-abata aridan-abata
Ibo	Nigeria	Dawadawa, nitta, nete
Djerma	Niger	Dosso
Kanouri	Niger, Nigeria and Chad	Runo
Mina	Togo	Woti
Fulbe	West Africa	Narghi

Distribution range of African locust bean

Geographical distribution

The natural range of African locust bean covers a broad area extending from Senegal in the west to Uganda in the east and includes Sudanian as well as Guineo–Congolese zones.

Importance and use

The most important product is a fermented paste that is made from the dried seeds. The flowers and immature pods are eaten by children. The pulp surrounding the seeds is transformed into pure dough or mixed with millet flour and eaten, especially by children on farms. The pulp and millet flour mixture is also used to produce other foods, such as couscous, porridge, a local drink, fritters and cakes.

The fermented seeds are processed to make a black, highly aromatic, tasty paste that has high protein content and is used as a spice or condiment. The name varies depending on the country and local language and includes *dawadawa* (Nigeria), *soumbala* (Burkina Faso, Mali), *afitin* (Benin), *iru* (Nigeria), *kinda* (Sierra Leone) and *nététou* (Gambia). Dried fermented seeds keep for more than a year without

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Soumbala from Burkina Faso, a food condiment obtained by fermentation of African locust bean seeds

Uses	Part of plant
Food	Flowers, pods, fruit pulp, seed
Fodder	Fruit, leaves
Fuel wood or wood production	Branches, stems
Soil protection	Whole tree
Medicines	Flowers, fruits, leaves, bark, roots


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Afitin from Benin


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Flour from the pods

refrigeration in traditional earthenware pots. Small quantities of fermented seeds are crumbled into traditional soups and stews during cooking. Because of its savoury taste and high protein and fat contents *dawadawa* is sometimes described as a meat or cheese substitute. However, it is usually eaten in small quantities. *Dawadawa* is also rich in vitamin B2. African locust bean probably contributes significantly to alleviating the most widespread nutritional problems in Africa, such as energy and protein deficiencies.

Seeds are used as a coffee substitute. They are also embedded in a mealy pulp, sometimes called *dozim* that is high in energy value.

The flowers and fruits are used as medicines. In addition, leaves and bark from the trunk or roots are used to treat various diseases and wounds.

Fruit and leaves are also important fodder for livestock.


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Cakes from the pulp


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Seeds for sale

Socio-economic value

The African locust bean tree is highly valued and is commonly left standing when woodland is cleared. The trees are often individually owned. *Dawadawa* constitutes the main economic value for the species. It is widely eaten throughout West Africa as a diet staple, and is used in one daily meal for up to 90% of the year in some areas. Giving gifts is an important social practice and *dawadawa* is one of the most appreciated culinary gifts in West Africa.

The seeds and processed products are frequently traded in local markets. Some 200 000 tonnes of seeds are collected every year in

northern Nigeria. The seeds commonly fetch two to four times as much as major staples such as maize, sorghum and millet on the market. Purchase of locust bean seed accounts for 10–20 % of regular weekly expenditures of most rural women in the Bassila region of Benin. In Burkina Faso seed sales account for up to 25% of household income.

Ecology and biology

Parkia biglobosa tree is deciduous with a very broad crown that may reach a height of 20 m.

The species grows under a wide range of conditions, where annual rainfall ranges from 600 to 1500 mm and the dry season lasts 5–7 months. It occurs in natural and semi-natural habitats such as savannahs and woodlands, sometimes on rocky slopes, stony ridges and sandstone hills. It is able to withstand drought because of its deep taproot. Together with the shea butter tree (*Vittelaria paradoxa*), African locust bean is one of the main components of agroforestry parklands in West Africa.

Reproductive biology

African locust bean flowers are hermaphroditic, which means that each flower is both male and female, but the trees are largely outcrossing. This implies a degree of self-incompatibility. Flowers are orange or red and seed pods are pink–brown to dark brown when mature, about 45 cm long and 2 cm wide. They may contain up to 30 seeds embedded in a yellow fleshy pulp. Seeds have hard seed coats, are large (mean weight of 0.26 g/seed) with large cotyledons forming about 70% of their weight.

Bats and some sunbirds (*Nectarinidae*) are reported to be important pollinators of the genus *Parkia*. However, in the savannah area, where bats are scarce, insects, notably bees, moths and wasps, are the main pollinators. With the long history of cultivation and use of the species across West Africa, humans are probably the main seed dispersers in many areas. Primates and small mammals are also potential seed dispersers in natural ecosystems.

Phenology

A link between the reproductive phase and leaf phenology has been observed. Leaves fall rapidly as increasing numbers of flowers appear and flushes of new foliage develop after flowering passes its peak. Flowering occurs near the end of the dry season, which lasts from December to April in West Africa, beginning later with increasing lati-

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African locust bean tree

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Different stages of flowering

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Different stages of fruiting

tude. Spasmodic flowering sometimes occurs in other months. The availability of soil moisture seems to be a major determinant of the onset of flowering. Fruit is produced from January to May.

Related species

Parkia is a pantropical genus. Debates continue in the literature on the number of species but there are five well recognized species besides African locust bean: *P. filicoidea*, *P. bicolor*, *P. roxburghii*, *P. biglandulosa* and *P. madagascariensis*.

Morphological traits and their variation

African locust bean has a dark grey–brown, thick, fissured bark. Leaves are alternate, dark green and bipinnate (doubly compound). They are up to 30 cm long and consist of up to 17 pairs of pinnae, with 13–60 pairs of leaflets on each. A high degree of variation has been documented in fruit production, fruit size and oil content. Trees in forests are generally taller than those in savannah areas but savannah trees have larger canopies.

Genetic knowledge

Genetic diversity is reported to be high, both within and among populations. On the basis of one study, the African locust bean appears to have considerably higher genetic diversity than most tropical tree species. Gene flow was estimated to be fairly low; less than two individuals on average moving between any two populations per generation. Differentiation between populations was substantial; 13% of the total diversity is estimated to be between populations and 87% is within, although the degree of differentiation between populations varies. Unpublished provenance trial results show a correlation between genetic differences and geographic distance.

Gene flow between populations is facilitated by the tree's reproductive biology, with high flowering synchronism and high level of cross-pollination and the parkland systems in which the tree commonly grows.

Local practices

Local people in West Africa identify different 'types' of African locust bean based on differences in morphology and fruit production. For example, people belonging to the Bariba ethnic group in north-east Benin recognize two types of African locust bean tree based on the fruiting period: trees that produce fruit early, in January, are known as *dom sinkou* while trees that produce fruits in March are called *dom*. In Burkina Faso, local people distinguish four types, according to seed size and colour: white, black, red and small seeds.

Tree tenure is an important factor in determining who can harvest and process which tree products. African locust bean trees on farms, whether planted or naturally established, are generally considered to be owned by men. Women have free access only to trees in forests in spite of the fact that they play a crucial role in harvesting and processing pods and seeds and adding value to them.

Threats

Land and tree ownership and use

The system of land and tree ownership and use policies and practices in West Africa may be a disincentive to the conservation and sustainable use of African locust bean. Women play the primary role in harvesting, processing and selling the most valuable product, *dawadawa*, but they do not own the trees nor can they make decisions about leaving trees standing during land clearance or conversion of parkland to other agricultural use.

Climate change

Successive droughts in recent years may have contributed to the observed poor regeneration of

the tree. Reduction in rainfall as a result of climate change poses a threat to the species, particularly to populations in more arid regions. There have been no studies of genetic variation in tolerance to drought stress, but populations in drier areas are likely to be the most tolerant; if there is little regeneration in those areas an important genetic resource may be lost.

Agricultural expansion and livestock grazing

African locust bean is mainly known from parklands rather than intact forest. The trees are aging in the parklands and regeneration is low because of a variety of factors related to human population pressures. The species requires fields to lie fallow for it to regenerate, but fields are no longer being left fallow. Mechanization of farming practices, uncontrolled bush burning and increased livestock grazing all reduce habitat for the tree. When intact forest is cleared for conversion to intensive agriculture, all trees are now commonly removed, whereas in the past the practice was to leave African locust bean trees standing.

Harvesting fruit and other products

Excessive harvesting of fruit may be one reason for the lack of regeneration observed in parklands. Girdling is often used to increase fruit production and it may have a detrimental effect on tree survival and vigour.

Conservation status

African locust bean is still fairly common, especially in the semi-natural and multi-cropped agroforestry parkland systems in sub-Saharan Africa. However, according to reports, the species is declining and conservation is urgently needed.

The seeds are orthodox, which means that they can be kept in long-term storage at 0-5°C with 5% moisture content. Proper seed handling is very important, however, as seeds lose viability if the moisture content is allowed to increase above about 5%. Several seedbanks in sub-Saharan

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Collecting and transporting African locust bean pods in Burkina Faso

Africa have *ex situ* collections of the species, including tree seed centres in Burkina Faso, Senegal and Togo.

It is not known how many populations are protected *in situ* in existing parks or other protected areas.

Some national institutions have established provenance trials. For example, the agricultural research institute (INERA) and the seed centre (CNSF) of Burkina Faso have trials established since 1984. Two international provenances with 15 provenances from 11 African countries established by CNSF in 1995 still exist and represent unique resources, both for gene conservation and for comparative studies.

Management and improvement

African locust bean trees are rarely planted but are a significant component of parkland agroforestry systems because farmers preserve valuable trees when they clear new fields. The selected trees benefit from the farm husbandry and consequently grow better and produce more fruit than trees in natural conditions. Farmers also practice girdling and branch pruning to stimulate fruit production or to reduce the negative influence of big trees on annual crops growing under their canopies.

Propagation from seed

Seeds can be kept for short periods in polyethylene bags at ambient temperature. The seed has a hard coat and should be soaked in concentrated sulphuric acid (98%) for three minutes, then thoroughly washed in water to increase germination. Alternatively, it should be dipped in boiling water for four seconds to soften the shell and then soaked overnight. Longer periods of treatment will damage the seeds.

Vegetative propagation

African locust tree can also be propagated vegetatively from rooting cuttings, air layering and tissue culture. This is an attractive option because it allows farmers to capitalise on trees with good traits and it may speed up fruit production.

Guidelines for conservation and use

African locust tree may be conserved through sustainable use, while ensuring that standard *ex situ* conservation measures are taken as a back up and *in situ* protection is afforded to unmanaged populations to allow them to continue to evolve under relatively natural conditions. *Ex situ* conservation efforts should focus on target populations in arid regions that have little or no natural regeneration. Other populations of importance are those that have been shown to have high genetic diversity or are known to have valuable characteristics for production. Data from the field trials in Burkina Faso and elsewhere should be used to guide collection of the most useful sources. Seed should be collected from at least 15 well-spaced trees in each population. Sampled populations should be distributed across a range of environments to capture potential adaptive variation. Enough seed should be collected to use in field studies in addition to quantities for long-term storage.

Populations conserved *in situ* in protected areas may be used and conserved at the same time, depending on the regulations associated with the particular protected area. Irrespective of the regulations, sufficient fruit must be left on site to allow natural evolutionary processes to occur and trees must not be removed or girdled.

It is important to ensure that women have a voice in land management to promote sustainable use and conservation. Farmers may be interested in participating in conservation projects if the revenues they derive from *dawadawa* and other products are considerably improved. Markets need to be developed to ensure long-term conservation and sustainable use of the species. The challenge for the establishment and maintenance of these conservation stands is how to financially support their existence for the long term. Regional and international partnership studies is indispensable to maintain such a programme.

Research needs

- Determine the number of viable populations in protected natural areas such as national parks
- Determine genetic variation in drought tolerance and identify location of important sources of variability
- Determine genetic variation in tree growth and fruit production parameters
- Identify pollinator species, investigate effective pollen flow and determine threats to pollinator species
- Investigate effectiveness of seed dispersal and degree of dependence on fauna that are rare or threatened
- Determine effective population sizes in semi-natural farmland populations and minimum viable populations for conservation and long-term sustainable use
- Develop best practices for nursery propagation
- Carry out reproductive phenology studies in different conditions. ■

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This leaflet was produced by members of the SAFORGEN Food Tree Species Working Group. The objective of the working group is to encourage collaboration among experts and researchers in order to promote sustainable use and conservation of the valuable food tree species of sub-Saharan Africa.

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