



## Blighia sapida

### Ackee



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Ackee (Benin)

#### Common name

Ackee, akee, akee apple (English)

Arbre à fricasser, aki (French)

Akí, seso vegetal, fruto de huevo, palo de seso (Spanish)

Castanheiro do Africa (Portuguese)

#### Scientific name

*Blighia sapida* K.D. Koenig

#### Synonyms

*Cupania sapida* Voigt

#### Family

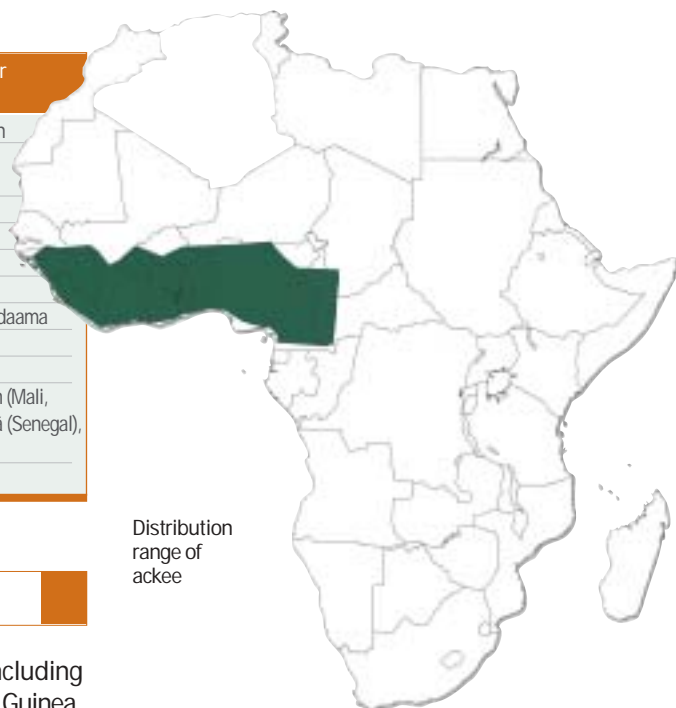
Sapindaceae

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This leaflet highlights the nutritional and socio-economic potential of ackee and provides information to assist those working with the species. The focus is on conserving genetic diversity and promoting sustainable use of ackee. 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
Yoruba	Benin	Iguishin, ishin
Fon/Mahi	Benin	Sissitin, lissètin
Batombu	Benin	Diremou
Ditamhari	Benin	Moufodom
Waama	Benin	Pourounbou
Fulbe	Benin	Pissadje
Natemba	Benin	Foulama, foudaama
Berba/Nyende	Benin	Afoukandone
Bidyogo	Guinea-Bissau	Otau
Bambara	Mali, Guinea, Senegal, Sudan	Finzan, finsan (Mali, Guinea), finzâ (Senegal), finza (Sudan)
Kissi	Sierra Leone	Maiyo-sundo



Distribution range of ackee

## Geographical distribution

Ackee is native to tropical West Africa including Benin, Cameroon, Côte d'Ivoire, Ghana, Guinea, Liberia, Nigeria, Senegal and Togo. It was introduced into the Caribbean by slave traders in the 18th century and has spread across the region. It is the national fruit of Jamaica, where it is commercially cultivated.

## Importance and use

Ackee fruit, leaves, bark and wood are used for a variety of purposes including food, fodder for goats and building materials and in the production of medicine, soap, insect repellent and poison used for catching fish. Trees are also planted for their ornamental qualities and shade.

The ackee fruit consists of a capsule that contains three seeds with a fleshy covering or aril. The aril is edible when fully mature but highly toxic when immature. The seeds are always poisonous. The mature aril is consumed fresh, added to sauce as an alternative to sesame seeds or peanuts, dried and ground into powder and added to sauces for its oil content, fried or parboiled with seasoning. Dried arils are the

commonest form on local markets, at least in northern Benin, where information is available. Young leaves may be parboiled and used like any other African leafy vegetable.

The capsules contain saponins, which lather in water and are used as a soap substitute and in soap-making. The bark, seeds and capsules are dried, finely ground and used to poison and catch fish. The ash of burned capsules repels some insect pests and is used locally on crops such as beans. A feeding trial determined that ackee leaves could be a good feed for West African Dwarf goats, especially during the dry season in the savannah zone of Nigeria. All parts of the tree (bark, capsules, seeds, roots,

Uses	Part of plant
Food	Aril, leaves
Fodder	Leaves
Furniture	Wood
Medicine	Bark, capsules, seeds, roots, leaves
Soap	Capsules
Insect repellent	Capsules
Poison for catching fish	Bark, seed, capsules
Ornament/shade	Whole tree



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Ackee fruit, seeds and arils for sauce cooking

leaves) are used as medicines in the treatment of a wide variety of ailments.

The wood is termite resistant and is used for making furniture. It is also used for charcoal production. There are no reports of it being exported.

### Socio-economic value

The economic potential of ackee is largely untapped in West Africa. The ackee industry in Jamaica, which is well developed, generated approximately US\$400 million in revenues in 2005. This indicates the potential for developing an ackee industry in West Africa.

The only economic data available from West Africa come from a survey of one rural township in Benin. This showed that 80% of arils harvested were dried and sold on local markets, generating



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Ackee leaves

almost 20% of household income in the township. By comparison, revenue from sales of maize accounted for 20% of household income, sorghum accounted for 21% and beans accounted for 15%. Dried arils are also traded in regional and transboundary markets. Ackee soap is sold on some local markets.

### Ecology and biology

Ackee is an evergreen tree that occurs naturally in mature or climax forests. It generally occurs naturally in areas that are wet enough to support closed-canopy forest, but not in humid forest. In cultivated areas and in fallows it grows well in full sun. It prefers fertile soils from sea level to more than 900 m elevation.



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Ackee inflorescence



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Fruit development

## Reproductive biology

Flowers are greenish, small, male or hermaphroditic (i.e. both male and female), in axillary racemes, and are pollinated by insects. Trees begin producing fruit at three to six years old when grown from seed. Fruit is a red, yellow or orange capsule, 5–10 cm long, opening at maturity, with three cream-coloured arils, each tipped with a black seed. Seeds germinate readily when fresh, but are recalcitrant, meaning that they do not maintain their viability when dried. Seeds are dispersed by humans and by large animals, including chimpanzees and large birds.

## Phenology

The phenology of ackee has been documented only in the Sudanian zone of Benin.

		Month and season											
		N	D	J	F	M	A	M	J	J	A	S	O
		Dry season						Rainy season					
Flowering		X	X					X	X				
Fruit development		X	X							X	X		
Fruit maturation					X	X					X	X	

## Related species

There are two other *Blighia* species: *Blighia welwitschii* (Hiem.) Radlk (with seven synonyms) found in the forest zone in Sierra Leone to West Cameroon, and across the Congo basin to Uganda and Angola and *Blighia unijugata* Baker (with five synonyms) found in evergreen forest, riverine forest, grassland with trees and termite mounds in Sierra Leone to West Cameroon, and across NE, E and S central tropical Africa. The ranges of the three species overlap but there is little information about their distinguishing characteristics.

## Morphological traits and their variation

Ackee is a large tree, reaching up to 35 m in forest conditions. It has a densely branched and

symmetrical canopy and smooth grey bark. Leaves are alternate, compound, with 3–5 pairs of glossy leaflets. Clusters of small, five-petalled greenish-white flowers are fragrant and showy. When ripe the fruit capsule is brightly coloured, ranging from yellow to red, and splits open.

Morphological differences have been reported only in Benin, where there is great variation in growth form and fruit traits across climatic zones and between open-grown and forest trees. Trees growing in open fields are shorter than those growing in a forest, but these open-grown trees have larger diameter and greater fruit production. However there are no reports of field experiments to test for inheritance of these traits.

## Genetic knowledge

There are no published reports documenting genetic variation in traits having adaptive or productive significance. The only reported studies on the genetic diversity of neutral molecular markers were based in Benin, where DNA markers have been investigated recently in six forest and eight field/fallow populations. These indicate moderate levels of molecular diversity and little differentiation among populations or climatic zones. Farmer-led domestication had an impact on the spatial distribution of genetic variation but did not result in significant losses of diversity within populations.

## Local practices

An ethnobotanical survey conducted in Benin found that farmers characterize ackee types using criteria that are mostly related to the fruit and its different parts. Farmers' preferences were most commonly related to fruit size, colour and taste. Farmers mentioned that trees under their management exhibited

their preferred traits more frequently than trees in the wild or that were unmanaged.

## Threats

Ackee is threatened by the same factors as other savannah tree species: deforestation, bush fires, intensification of agriculture, livestock grazing and shifting rainfall patterns. Trees are also harvested for their wood for lumber and charcoal production but the degree to which cutting threatens the species is not known.

The bark of some trees in Benin is systematically removed and used in traditional



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Ackee bark used for medicinal purposes

medicines but it is not clear to what extent this practice affects the growth, fruit production, health or even life of the trees. Future studies should investigate the impact of bark harvesting on the species.

## Conservation status

Ackee is present in home gardens and parklands in many countries in sub-Saharan Africa where it has a degree of protection because of its economic value. It also occurs in national parks, sacred forests and protected

forest reserves in the Guinean zone across the region, but the number and distribution of stands in protected areas is not known, so it is not possible to estimate the adequacy of *in situ* protection.

There are no known *ex situ* conservation efforts. The recalcitrant seed would not maintain viability in a seed bank and there are no reports in the literature of field clone banks or provenance trials.

## Management and improvement

### Selection and domestication

Tree improvement and domestication activities have not yet been initiated by any research or management institution in West Africa, but trees are commonly planted near homes to provide a variety of products and services so farmers are practicing artificial selection and the early stages of domestication.

Three regeneration techniques for ackee are recorded in Benin: sowing, transplanting and assisted tree regeneration. The reason behind each regeneration method and the practical implementations are summarized in *Table 1*.

Farmers interviewed in Benin were interested in cultivation and improvement of ackee and 55% of respondents would like access to vegetative propagation techniques. Traits considered important for improvement included arils with higher oil content (35% of respondents), capsules and seeds with higher saponin content (30%), early fruiting varieties (26%), trees bearing fruits in different seasons (25%), smaller trees (20%) and trees with a prolonged period of fruit maturation (15%).

Farmers practice pruning, ringing, grazing protection, tree/crop association, fire protection and mulching to improve production (*Table 2*).

### Propagation from seed

Ackee may be grown from seed, but the seed

**Table 1** Propagation and regeneration of ackee in Benin

Propagation and regeneration practices	Reason/function	Implementation
Sowing	Multiply the best trees after selection	Seeds from the most vigorous trees or those with the highest fruit yield are selected and put together. After germination during the rainy season, they are transplanted to an appropriate location to receive care.
Transplanting	Use naturally regenerated seedlings and saplings	Seedlings and saplings are removed and replanted in an appropriate area and given essential care.
Assisted tree regeneration	Favours natural regeneration	Young plants are staked to be easily visible and protected from tillage, grazing and fire.

**Table 2** Management practices for ackee in Benin

Practices	Reasons/function	Implementation
Pruning	Improved fruit production, reduction of shade on understorey crops, firewood	Cutting back certain branches
Ringing	Stimulate fruit production	A shallow 10 cm-wide ring of bark is cut from the trunk at breast height just before flowering
Grazing protection	Avoid destruction of seedlings and saplings by domestic animals	Establish fence of cactus or rocks around the seedlings and saplings
Tree/crop association	Diversification, soil protection, shade for crops, creation of microclimate favourable for crops	Leave naturally established or planted ackee trees in farmland and plant crops such as millet, sorghum, maize or yam in the same field
Fire protection	Fire damage reduces fruit yield and kills seedlings and saplings	Tillage, weeding and clearing around the seedlings, saplings and trees
Mulching/ organic fertilization	Rapid growth of seedlings and saplings and increasing fruit production	Leaf mulch, animal manure, compost and crop residues near the root and sprinkling with water

should be planted within a few days of extraction from the fruit because it loses viability rapidly. Once planted, seed may take 2-3 months to germinate. Seedlings should be protected from domestic livestock until they are at least 2 m tall.

### Vegetative propagation

Vegetative propagation methods have not been developed in Africa but grafting, budding and rooted cuttings are recommended for plant production in Florida, USA. Specific methods are not documented in the published literature so they need to be developed as part of a domestication programme.

Farmer participation is recommended in the establishment and management of nurseries for production of grafts or rooted cuttings. Including more than one village in the development of each nursery will increase effectiveness by capturing differences in indigenous knowledge and preference for fruit traits among ethnic groups and between men and women. Guidelines on the number of trees selected for vegetative propagation must be established and followed to ensure that the gene pool will not be reduced to an unsustainable level if vegetative propagation replaces regeneration from seed.

## Guidelines for conservation and use

*Circa situ* conservation, in which trees are managed in various agroforestry systems (trees on farmland, home gardens, agroforests, parkland systems), is a viable approach for ackee conservation. Guidelines will have to be followed to ensure that genetic variation is maintained in the production systems and wild populations must receive *in situ* protection in parks and forest reserves to ensure that the genetic base is maintained.

The best way to guarantee *circa situ* conservation of ackee in agroforestry systems is to ensure the availability of a diversity of types for farmers who are interested in planting the species. Seeds or vegetative material for nursery propagation should be collected from trees meeting various market-oriented ideotypes, ensuring that nursery stock will be highly variable in many desirable traits. Any conservation management programme should combine local knowledge of the species and local preferences with scientific genetic knowledge.

Fruits should be collected from 15 to 20 trees near each village where farmers are interested in participating in an improvement effort. Farmers should be involved in selecting trees based on traits important to them. Use and exchange of germplasm should be confined within ecological zones to avoid negative effects of maladaptation. Involving both men and women and people of different ages in selecting trees, collecting fruit and nursery production will increase the range of traits that are considered important, thus increasing genetic variation included in the collection.

If the existing protected areas networks in the region are properly managed, *in situ* conservation of ackee can be accomplished by documenting the presence of stands and ensuring that populations remain large and healthy. If ackee is not present in existing protected areas in a particular region, carefully managed areas providing both *in situ* protection and livelihoods for rural people can be established with the involvement of the local population and forest authority.

*Ex situ* conservation should be undertaken if there is evidence of species decline or of populations disappearing. Field clone banks will likely be the most effective means of *ex situ* conservation. Sampling for *ex situ* conservation should be based on molecular genetic structure until provenance or progeny trials are established to evaluate patterns of useful genetic variability. If the genetic structure in Benin is characteristic of the structure throughout the species' range, the sampling strategy should ensure that all climatic zones are included, and additional emphasis should be placed on populations near the most arid extremes of the range.

## Research needs

- Develop in a participative way, an appropriate low cost vegetative propagation techniques suitable for farmers in sub-Saharan Africa
- Improve the processing, storage and packaging of arils
- Determine the number of viable populations in protected natural areas such as national parks and the degree to which the populations are protected within the areas
- Investigate the impact of bark harvest on viability of populations
- Develop *ex situ* conservation methods
- Determine genetic variation in drought tolerance and location of important sources of variation
- Determine genetic variation in tree growth and fruit production
- 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. ■



## *Blighia sapida* Ackee

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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## Bibliography

- Crane JH and Balerdi CF. 2008. Ackee growing in the Florida home landscape. HS1128. University of Florida, USA. Available at: <http://edis.ifas.ufl.edu/HS378>. Accessed 16 February 2010.
- Dossou MKR, Codjia JTC and Biaou G. 2004. Rôle de la ressource forestière *Blighia sapida* (ackee ou faux acajou) dans l'économie des ménages du Nord-Ouest du Bénin. Bulletin de la Recherche Agronomique du Bénin 46:33–41.
- Ekué MRM, Assogbadjo AE, Mensah GA and Codjia JTC. 2004. Aperçu sur la distribution écologique et le système agroforestier traditionnel autour de l'ackée (*Blighia sapida*) en milieu soudanien au Nord Bénin. Bulletin de la Recherche Agronomique du Bénin 44:34–44.
- Ekué MRM, Gailing O, Finkeldey R and Eyog-Matig O. 2009a. Indigenous knowledge, traditional management and genetic diversity of the endogenous agroforestry species ackee (*Blighia sapida*) in Benin. Acta Horticulturae 806:655–661.
- Ekué M, Gailing O and Finkeldey R. 2009b. Transferability of simple sequence repeat (SSR) markers developed in *Litchi chinensis* to *Blighia sapida* (Sapindaceae). Plant Molecular Biology Reporter 27:570–574.
- Ekué MRM, Sinsin B, Eyog-Matig O and Finkeldey R. 2010. Uses, traditional management, perception of variation and preferences in ackee (*Blighia sapida* K.D. Koenig) fruit traits in Benin: implications for domestication and conservation. Journal of Ethnobiology and Ethnomedicine, 6, 12.
- ICRAF. n.d. Agroforestree database [online]. Available at: <http://www.worldagroforestrycentre.org/sites/treedbs/aft.asp>. Accessed 16 February 2010.
- Pen M. 2006. Viable ackee industry must be protected – BSI Inspector [online]. Available at: [http://www.jis.gov.jm/agriculture/html/20060506T100000-0500\\_8777\\_JIS\\_VIABLE\\_ACKEE\\_INDUSTRY\\_MUST\\_BE\\_PROTECTED\\_\\_BSI\\_INSPECTOR.asp](http://www.jis.gov.jm/agriculture/html/20060506T100000-0500_8777_JIS_VIABLE_ACKEE_INDUSTRY_MUST_BE_PROTECTED__BSI_INSPECTOR.asp). Accessed 16 February 2010.

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