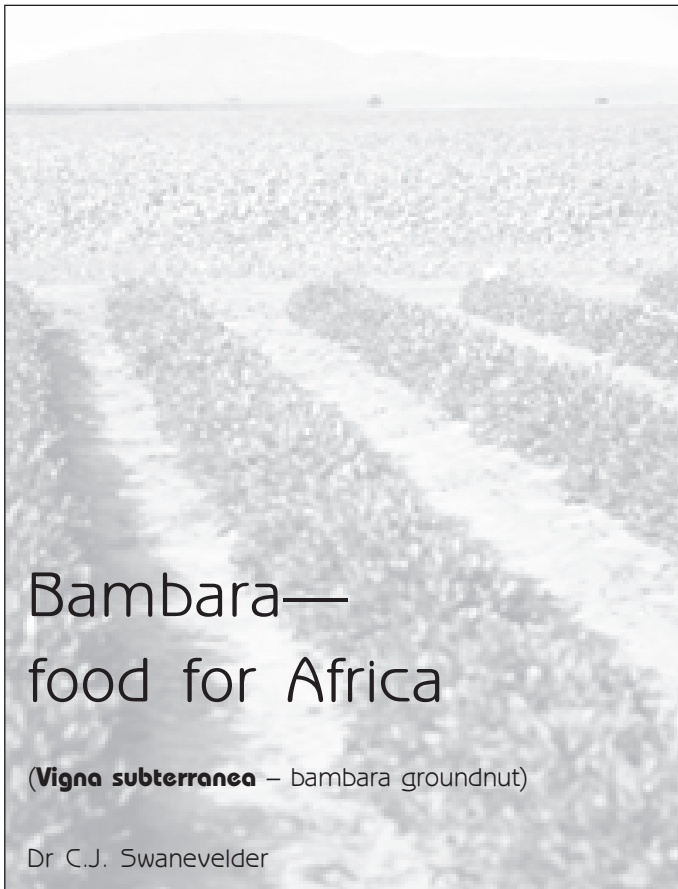




Bambara— food for Africa

(*Vigna subterranea* – bambara groundnut)

Dr C.J. Swanevelder



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Bambara groundnut

(*Vigna subterranea*)

Introduction

Jugo, njugo, bambara or round beans are widespread in Africa and have various names—each language and dialect has its own variation. In the literature the name bambara groundnut is commonly used.

The beans are related to cowpeas and botanically known as *Vigna subterranea* (L) Verdc. There are two botanical varieties namely *V. subterranea* var. *spontanea* which includes the wild varieties and *V. subterranea* var. *subterranea* which includes the cultivated varieties.

Although it produces a nutritious food and is cultivated throughout Africa the bambara remains one of the crops most neglected by science. Yet empirical evidence and fragmentary research results suggest that it is a crop with great potential.

The bambara groundnut has become less important in many parts of Africa because of the expansion of groundnut production. In recent years there has, however, been renewed interest in the crop for cultivation in the arid savannah zones. Bambara is a popular crop because of its resistance to drought and the ability to produce a reasonable crop when grown on poor soils.

Bambara groundnut in South Africa

Bambara beans originated from North Africa and through migration of indigenous peoples moved as far south as KwaZulu-Natal. It is confined to the Northern Province, Swaziland and KwaZulu-Natal.

The name of this African groundnut originates from Bambara, a district on the Upper Niger near Timbuctoo. Because it is widely cultivated throughout tropical Africa, the Bambara district has no pre-eminent claim to the plant.

Diversity of opinion exists among the different tribes as to who first brought bambara to the southern part of Africa. The Bolebedu of Letaba claim they came with it from the north. They arrived south of the Limpopo before the Venda, who in turn assert that they brought bambara from Central Africa to the Transvaal. The latter contention is substantiated by two factors: The Venda name “Nduhu-mvenda”, meaning the groundnut of Vendaland, which is still frequently used, shows that there is some truth in the contention. Furthermore, the harvest ritual is customary for “phonda” (*Vigna subterranea*) among the Venda.

Bambara groundnut is the second most important food legume and the third food crop after maize and groundnut grown by the small-holder farmers in Mpumalanga. The immature seeds are boiled and eaten as an early harvested source of food and the fully-matured seeds are cooked or made into flour. Bambara groundnut is widely grown by almost all small-scale farmers.

It is cultivated both as an intercrop with maize, cowpeas and melons and as a sole crop. The size of bambara plots range from 300 to 2 500 m²/farmer.

Commercial value and uses

- ❖ Bambara groundnut is mainly used for human consumption. The seeds are consumed either when immature or fully ripe and dry.



- ❖ Immature seeds are consumed fresh or grilled. They can also be boiled, either shelled or unshelled, and eaten as a meal or mixed with immature groundnuts or green maize.
- ❖ Ripe/dry seeds are hard and therefore difficult to grind. Usually they are either pounded to flour and boiled to a stiff porridge, or soaked and then boiled. The porridge keeps well and is traditionally used on journeys.
- ❖ Ripe/dry seeds are also roasted, broken into pieces, boiled, crushed and eaten as a relish with “sadza” (maize-meal porridge).
- ❖ In restaurants in Angola and Mozambique, boiled salted seeds are often served as appetisers. Commercial canning of bambara groundnut in gravy is a successful industry in Ghana.

Morphology

The Bambara groundnut is an annual legume with a compact well-developed tap root with many short (up to 20 cm long) lateral stems on which the leaves are borne. The leaves are trifoliate (\pm 5 cm long), the petiole (up to 15 cm) is long, stiff and grooved, the base is green or purple in colour.

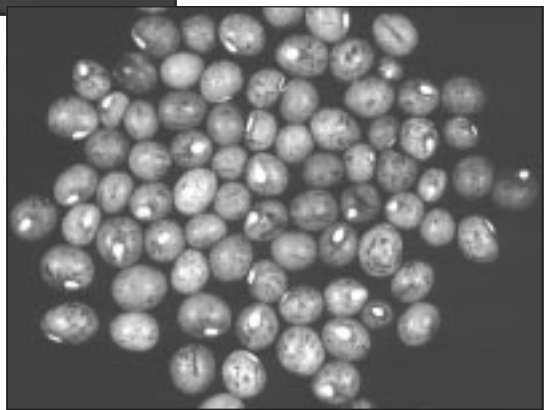
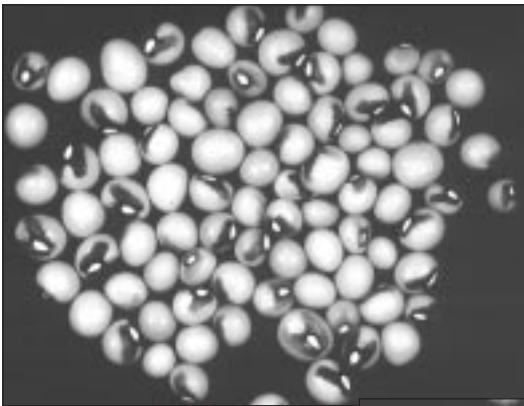
The flowers are typically papilionaceous and are borne in a raceme on long, hairy penduncles which arise from the nodes on the stem. The branching types are usually self-pollinated while the spreading types are usually cross-pollinated by ants.



Bambara produces its pod at the base of the plant at soil level

Like the groundnut, it forms pods and seeds on or just below the soil surface.

The pod is small (1,5 cm long), round or slightly oval shaped and wrinkled with mostly one or sometimes two seeds. The unripe pod is yellowish green, while the mature pods may be yellowish green or purple. After fertilisation the flower stem elongates. The sepal enlarges and the fruit develops above or just below the soil surface. The colour of the testae varies according to ripeness from light yellow to black, purple and other shades. The seeds are round (up to 1,5 cm diameter), smooth and when dried, very hard. They are cream, brown, red, mottled, with or without hilum colouration.



The colour of the seeds range from cream to purple. Other colour possibilities are red, brown or mottled



Growth and development

Bambara beans take 7 to 15 days to germinate. Seed stored for about 12 months germinate well, but longer storage results in loss of viability.

Flowering starts 30 to 35 days after sowing and may continue until the end of the plant's life. It is a typical short-day plant and the following variations were observed:

- ❖ Day neutral but fruit forming is delayed by long days.
- ❖ Day neutral but fruit setting is prevented by long days.
- ❖ Delayed flowering and no fruitset under long-day conditions.
- ❖ No flowering under long-day conditions.

Vegetative growth takes place in spring and early summer and pods form only in late summer and autumn. Pod and seed development take place approximately 30 to 40 days after fertilisation.

The fruit of bambara groundnut develops on or below the soil surface.

- ❖ The pod develops first. This takes up to 30 days after fertilisation.
- ❖ The seed develops during a further 10 days. Seeds are mature when the parenchymatous layer surrounding the embryo has disappeared and the pods become light brown.



A young bambara plant at onset of flowering

Climate

- ❖ Bambara can be cultivated up to 1 600 m above sea level.
- ❖ An average day temperature of 20 to 28 °C is ideal for the crop.
- ❖ Bambara beans should do well under weather conditions suitable for groundnuts.
- ❖ A growth period of 110 to 150 days is required for the crop to develop.
- ❖ Widespread rain during the growing season (600–700 mm) is ideal.
- ❖ Too much rain at harvest time, however, may damage the crop.

Soil requirements

- ❖ Bambara beans will grow on any well-drained soil, but light, sandy loams with a pH of 5,0 to 6,5 are most suitable.
- ❖ The crop does well on poor soil which is low in nutrients.
- ❖ Abundance of nitrogen favours vegetative growth.
- ❖ Bambara beans grow poorly in calcareous soil.

Cultivation

Soil preparation

Bambara gives the best yields on a deeply ploughed field with a fine seedbed. A level seedbed is best, but it can be planted on ridges when very wet conditions prevail.

Fertilisation

Information on fertilisation requirements is lacking in the literature. The chemical composition of the plant is made up of the following elements (Table 1):





Bambara in cultivar trials at the ARC – Grain Crops Institute

TABLE 1. Macroelements: bambara beans (% dry material basis)

	K	Mg	Ca	P	N
Roots	1,5	0,6	0,9	0,2	2,7
Leaves	1,1	0,5	2,6	0,2	1,8
Seed	1,6	0,2	0,1	0,6	3,9

The roots are not normally removed and the leaf:seed ratio is approximately 75:81. In other words, 1 000 kg seed and 925 kg leaves remove the following quantities of elements from the soil:

Element	Quantity removed kg
K	26,2
Mg	6,6
C	25,1
P	7,8
N	55,7

Nitrogen is supplied by the Rhizobium bacteria of the cowpea group and seed should be inoculated. Research in other countries shows that nitrogen and phosphate application had no influence on yield. Applications that vary from 40 kg ammonia sulphate and 60 kg superphosphate and up to 112 kg/ha ammonia sulphate and 336 kg/ha superphosphate at planting had no influence on yield. Local data is lacking and for the interim period nutrient removal according to yield expectations can be used as a guide for P and K fertilisation. Because of a strong developed tap-root system shallowly placed potassium is of no value.

Planting date

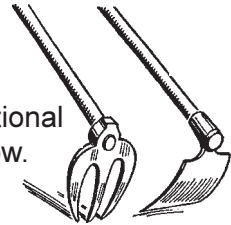
- ❖ Bambara is sown during October and November after good rains.
- ❖ Later plantings produce lower yields.

Seed rate and spacing

- ❖ Seed size varies and therefore seeding rate can vary from 25 to 75 kg/ha. The average 1 000 seed mass is about 500 to 750 g.
- ❖ The recommended spacing is 10 to 15 cm in single rows 45 to 90 cm apart.
- ❖ In Swaziland the highest yield was obtained with 50 cm row spacings.

Planting method

- ❖ Planters with the correct plates can be used.
- ❖ In Africa a hoe is used to plant seed in the traditional way. It is usually sown and covered with a harrow.

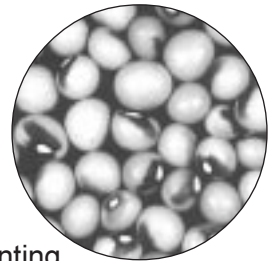


Planting depth

- ❖ In conditions of high moisture levels and in heavy soils (which cannot be recommended) seed can be planted 2,5 to 3,0 cm deep and 5,0 to 7,5 cm in sandy soil.

Seed treatment

- ❖ Large seeds are recommended.
- ❖ The seed should be treated with a fungicide.
- ❖ Seed vigour deteriorates after shelling, and shelling should therefore be done prior to planting.
- ❖ Germination takes 7 to 15 days.



Weed control

There are no registered herbicides and weed control is done mechanically or by hand.

Ridging (earthing up)

There is a contradiction concerning the benefits of ridging. Results of ridging trials show an advantage, but the occurrence of *Sclerotium rolfsii* can be increased with ridging. Ridging of bambara is, however, practised by farmers throughout Africa.

Trials conducted in South Africa also show variation in the results, which makes recommendation impossible.

TABLE 2. The seed yield of bambara at different ridging times

Time of ridging Days after planting	Yield kg/ha	
	Potchefstroom	Alma
Planting dates	23/11/88	01/11/88
Control	824	3 113
25	311	2 898
50	973	3 504
75	924	3 597
100	1 038	3 542
Mean	814	3 331
CV (%)	37	23,3
LSD (5 %)	286	737



It is the custom to earth up bambara at the start of pod set

Harvesting

- ❖ Small areas are harvested by hand as the plants turn yellow or die, or when about 80 % of the pods have matured.
- ❖ Large areas should be harvested when the plants wilt or turn yellow or when about 80 % of the pods have matured.
- ❖ The tap root can be cut with a groundnut harvester or ploughed out, or the beans can be lifted or hoed out.
- ❖ The pods break off very easily and up to half of the pods can remain in the soil and have to be collected by hand.
- ❖ After the plants have been cut they can be left for a day or two after which they can be stacked in wind rows to dry.
- ❖ The pods can be picked by hand or by using a commercial groundnut picker.
- ❖ The plants must be handled with care to reduce pod loss.
- ❖ Groundnut shellers can be used but more experimental work is necessary before a recommendation can be made.
- ❖ The shelling percentage of bambara is approximately 75 %.

Crop rotation

- ❖ Bambara can be cultivated singly or with other crops.
- ❖ It is cultivated commercially as a single crop, but is usually intercropped with babala, sorghum, maize and tuberous crops.
- ❖ It is usually planted after maize in commercial production systems.

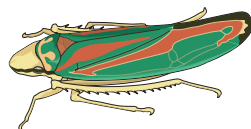
Diseases and pests



Infection by diseases and pests that can influence yield have not been observed yet. In locally planted trials *Sclerotium rolfsii* has caused yield losses. It has been reported that a number of diseases may occur.

Various viruses have also been reported as being problems on bambara.

- ❖ *Meloidogyne incognita* and *M. javanica* are parasitic nematodes on bambara.
- ❖ Pests attacking bambara are leafhoppers, *Hilda patruelis* and the larvae of *Diacrisia maculosa* and *Lamprosema indicata*.
- ❖ Developing pods of bambara beans are damaged by *Piezotrachelus ugandum* (moth beetle), while larvae of the genus *Rivellia* cause damage to the root nodules.
- ❖ There are no chemicals registered for the control of diseases and pests on bambara in South Africa.



Storage

Pests on seed such as *Callosobruchus maculatus*, *C. subinnotatus* and *Ctenocampa hilda* cause problems. The necessary control measures must be applied to protect the seed in storage.

Yield

In the literature yields vary from 50 up to 4 000 kg/ha. Yields of over 3 000 kg/ha were obtained in a cultivar trial conducted by the ARC at Potchefstroom.

The demand world wide for bambara is greater than production. The price varies according to demand and supply, from R3,00 to more than R20,00/kg (1998 price).

It is one of the most important crops in Africa, but because of pod losses during harvesting, superstition and traditional preferences the market is undersupplied.

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