

- PRODUCTION GUIDELINE -



Bambara Groundnuts

(Vigna subterranea)



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Bambara Groundnuts

(Vigna subterranea)

2016

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

2016

Printed and published by
Department of Agriculture, Forestry and Fisheries

Design and layout by
Communication Services
Private Bag X144, Pretoria 0001

DISCLAIMER

This document has been compiled by the Department of Agriculture, Forestry and Fisheries and every effort has been made to ensure the accuracy and thoroughness of the information contained herein. The department cannot, however, be held responsible for any errors, omissions or inaccuracies in such information and data, whether inadvertent or otherwise. The Department of Agriculture, Forestry and Fisheries, therefore, accepts no liability that can be incurred resulting from the use of this information.

Contents

Part 1: General aspects

- Classification 1
- Origin and distribution 1
- Production levels 1
- Major production areas in South Africa 2
- Varieties and cultivars 2
- Description 3
- Climatic requirements 5
- Soil requirements 5

Part 2: Cultivation practices

- Propagation 5
- Soil preparation 5
- Planting 6
- Fertilisation 6
- Irrigation 6
- Weed control 6
- Pest control 7
- Disease control 7
- Other cultivation practices 8
- Harvesting 8

Part 3: Post-harvest handling

- Sorting 9
- Packing 9
- Storage 9
- Marketing 9

Part 4: Utilisation 9

- Production schedule 10

References 10

Part I: General aspects

1. CLASSIFICATION

Scientific name: *Vigna subterranea* (L.) Verdc

Common names: Bambara groundnut; Jugoboone, ditloo-marapo, izindlubu, Indlubu, jugo bean, nduhu, phonda, ndlowu, njugo, tindlubu, inhlowa

2. ORIGIN AND DISTRIBUTION

Bambara groundnut, (*Vigna subterranea* (L.) Verdc.) originated from the African continent and has been cultivated in tropical Africa for centuries. The common name actually appears to be derived from a tribe, the Bambara, a district on the upper Niger near Timbuctoo. It was taken at an early date to Madagascar, probably by the Arabs. It has reached Brazil and Surinam early in the seventeenth century and was later taken to the Philippines and Indonesia. It is the third crop among the grain legume crops of the African lowland tropics after the popular groundnut cowpea. The bambara groundnut has become less important in many parts of Africa because of the expansion of its production. In recent years there has been renewed interest for cultivation in the arid savannah zones.

3. PRODUCTION LEVELS

3.1 South Africa

In South Africa it is produced by local people mostly for subsistence purposes. It was only in recent years that people started selling it in local markets (e.g. boiled groundnuts). It is cultivated as an intercrop with maize, cowpeas and melons and as a sole crop. The size of Bambara plots range from 300 to 2500 m² per farmer. The crop is not grown commercially in South Africa, they were neglected by National Research Institutes in the past and therefore, little was known about the optimum agronomic practices for this crop.

3.2 Internationally

Reliable production figures for Bambara groundnut are difficult to obtain, because the crop is mainly grown for human consumption and local markets.

The estimated production in Africa is about 330 000 tons. Nigeria leads in production with 100 000 tons followed by Burkina Faso, Ghana, Mali, Cameroon and Ivory Coast. It is grown at subsistence level in almost all the sub-Saharan countries in Africa.

4. MAJOR PRODUCTION AREAS IN SOUTH AFRICA

In South Africa major production areas of Bambara groundnut is in the Limpopo, Mpumalanga, North West, Gauteng and KwaZulu-Natal provinces. In the Limpopo, Bambara groundnut is grown in Mopani, Capricorn, Waterberg and Vhembe districts. In Mpumalanga the production is extensively in Ehlanzeni district. In KwaZulu-Natal it is grown in Greytown, Msinga, Nkandla, Nguthuthu, Makhati, and Kosibaai areas. It is also grown on a minor scale in Umzinyathi and Illembe districts.

5. VARIETIES AND CULTIVARS

There are two botanical varieties known as *V. subterranean var. spontanea* which includes wild varieties and *V. subterranean var subterranean* which includes cultivated varieties. The seven types of the bambara groundnut cultivated varieties include:

- **Black:** Early maturing, usually small to medium-sized kernels. Mainly one-seeded
- **Red:** Late maturing. Kernels are large. A good yielder, however, it is prone to rotting onsite
- **Cream/black eye:** A large kernel and a good yielder
- **Cream/brown eye:** A moderate kernel and a good yielder
- **Cream/no eye:** Very small pods and kernels. It mainly produces one seed and yields are lower.
- **Speckled/flecked/spotted:** Purple colour predominates. Kernels are small and pods are mainly one-seeded.
- **Brown:** Continuous variation between light and dark brown. Kernels are of medium to large size.

The bambara varieties, in general are location specific in their photoperiod requirements and consequently, high yielding varieties from one locality may fail to do well in another place. Therefore, emphasis has been given in selecting and improving local cultivars than the introduction of exotic varieties.

6. DESCRIPTION

6.1 Mature plant

The bambara groundnuts are herbaceous annual plants with creeping stems at ground level. It takes about three to six months to mature, depending on weather conditions and the cultivar.

Roots

A compact well-developed taproot with many profuse geotropic short lateral roots 20 cm long. The roots form nodules for nitrogen fixation, in association with African wild-type *Rhizobia*.

Stem

It has lateral stems which develop from the root.

Leaves

The leaves are trifoliolate (\pm 5 cm long) and are attached to the stem by the petiole. The petioles are about 15 cm long, stiff and grooved, and the base is green or purple in colour. Leaves and flower buds arise alternately at each node. Leaves are pinnately trifoliolate, glabrous with erect petiole and thickened at the base. Two stipels are subtend to the terminal leaflet, while only one is assigned to each of the two lateral leaflets. The oval leaflets are attached to the rachis with marked pulvini. The terminal leaflet is larger than the lateral leaflets, with an average length of 6 cm and an average width of 3 cm.

Flowers

The flowers are typically papilionaceous and are borne in a raceme on long, hairy peduncles which arise from the nodes on the stem. The branching types are usually self-pollinated while the spreading types are cross-pollinated by ants. Flowering starts 30 to 35 days after sowing and may continue until the

end of the plant's life. After fertilisation, the flower stem elongates. The sepal enlarges and the fruit develops above or just below the soil surface.

Pods

The pods usually develop underground after pollination and fertilisation. The unripe pod is yellowish green, with up to six pods, while the mature pods may be yellowish green or purple. The pod is small; about 1 to 5 cm long, round or slightly oval shaped and wrinkled with mostly one or sometimes two seeds. Mature pods are indehiscent, wrinkled, ranging from yellowish to reddish dark brown in colour.

Seeds

The seed is hard, smooth, usually round and varying in size, it could come up to 1,5 cm in diameter. It also varies in colour from white, cream, dark brown, red or black and may be speckled or patterned with a combination of the colours. The average seed mass is about 500 to 750 grams.



Picture 1: Bambara groundnut seeds

6.1 Essential part

The essential parts are the pods.

7. CLIMATIC REQUIREMENTS

7.1 Temperature

The bambara groundnut is a fast growing plant, which requires warm temperatures and does not tolerate freezing temperatures during the growing season. A growth period of 110 to 150 days is required for the crop to develop. The optimum temperature for germination of the bambara groundnut is 30 °C to 35 °C and sprouting can takes 5 to 21 days. An average day temperature that is ideal for the crop development is from 20 °C to 28 °C. Extreme temperatures cause dying of the leaves, resulting in the reduction of the biomass yield.

7.2 Rainfall

The bambara groundnuts need moderate rainfall from sowing until flowering. An annual rainfall of 500 to 1200 mm is required during the growing season. The plant tolerates heavy rainfall, but too much rainfall at harvest may result in yield losses. The bambara groundnut can also survive in hot dry areas where other crops would not survive.

8. SOIL REQUIREMENTS

Bambara groundnut can be grown in poor, sandy to sandy loam and well-drained soil, which make it easier to harvest. Generally it performs better on poor soils than groundnuts. Yield of bambara groundnut on low-fertility soils are generally higher than those of groundnuts grown on similar soil. Bambara groundnut prefers a soil with a pH of 5,0 to 6,5.

Part II: Cultivation practices

1. PROPAGATION

The bambara groundnut is propagated by seed.

2. SOIL PREPARATION

The bambara gives the best yields on a deeply ploughed field with a fine seedbed. For compacted soil and weed infested areas, ploughing, followed by about two times of harrowing, it is recommended to ensure good germination and stand. A level seedbed is best; however, it can be planted on ridges when very wet conditions prevail.

3. PLANTING

Planting of the bambara groundnut can be done either as an intercropped plant with cereal crops or singly. It is planted from October to early December after good rainfall. Late planting results in poor establishment and significantly lower yields. Seeds should be treated with thiram (thiulin) before planting. In conditions of high moisture levels and heavy soils (not recommended) seed can be planted 2,5 to 3,0 cm deep and 5,0 to 7,5 cm deep in sandy soil, with a recommended spacing of 10 to 15 cm in single rows of 45 to 90 cm apart. Germination takes seven to 15 days.



Picture 2: Bambara groundnuts field

4. FERTILISATION

Local data on fertilisation is lacking and therefore nutrient removal according to yield expectations can be used as a guide for P and K fertilisation. Excess nitrogen encourages vegetative growth in expense of crop yields. Because of a strong developed tap-root system shallowly placed, potassium is of no value. Phosphorus fertiliser has no beneficial effect on the yield as well.

5. IRRIGATION

No statistical data on water management of the bambara groundnut is stored as the crop is commonly grown under rainfed conditions.

6. WEED CONTROL

Weed control is done chemically before planting, mechanically or by hand. Registered pre-emergent herbicides may be used for effective control of

weeds on the bambara fields. Hand hoe can also be used but care should be taken when weeding around the plant, especially at flowering as the flower stalks are fragile and may break with rough handling. Hoeing should be done twice to keep the plot free from weeds.

7. PEST CONTROL

Root-knot nematodes (*Meloidgyne incognita*, *M javanica*) can seriously reduce yield. Pest germinating seeds include rodents, termites, ants and cutworms (*Agrotis*). The plant may be attacked by insects such as aphids, groundnut jassid (*Empoasca facialis*), groundnut hopper (*Hilda patruelis*) and brown leaf beetles (*Ootheca mutabilis*). Control measures of insect pest include the use of insecticides e.g Malathion against aphids. Important storage pests are the bruchids beetles and the maize weevils. Infestation often begins in seeds ripening in the field and carried into the store. Stored seeds are sometimes protected by applying ash or chemical products such as Malathion or Carbamyl.

Alectra vogelii (Mhlilwane) was found to be a serious root parasite of bambara especially in Mpumalanga and causes yield reduction of up to 49 %. Two local variety selection, MPB51 and MPB31 have been developed by the Lowveld Research Unit for higher yields (2355 kg) and high tolerance to *A. vogelii* respectively.

Pests on storage such as *Callosobruchus maculate*, *C. subinnotatus* and *C.tenocampa hilda* cause problems. If shelled, the seeds have to be treated with in-secticidal dust before storage. At times seeds are stored with sand or treated with wood ash to prevent insect damage on seed. However, better results are obtained with vegetable oils.

8. DISEASE CONTROL

The most dreadful diseases that attack the bambara groundnut are Cercospora leaf spot (*Cercospora* spp.), powdery mildew (*Erysiphe polygoni*) and fusarium wilt (*Fusarium oxypolygoni*).

Symptoms of cercospora leaf spot are reddish-brown circular spots on the leaves, as well as lesions on the stems, petioles and pods. In severe attacks, leaves fall and the plant may die. The diseases can be reduced by practising crop rotation or burning of crop debris of the previous season as well as use of resistant cultivars.

Fusarium wilt causes vascular discolouration, yellowing, necrosis and wilting. Affected plants become stunted and die. Fusarium wilt can be controlled by use of resistant cultivars and crop rotation.

There are no chemicals registered for the control of diseases and pests on the bambara groundnut in South Africa.

9. OTHER CULTIVATION PRACTICES

Earthing up (Ridging)

Earthing up is heaping of the soil up around the base of the bambara groundnut. Earthing up after the development of flowers is found to have positive effect on yield and also facilitate easy harvesting. The occurrence of *Sclerotium rolfsii* can be increased with earthing.

Crop rotation

The crop is usually planted after maize in commercial production systems. This is also cultivated as single crop, but usually intercropped with sorghum, maize and tuberous crops.

10. HARVESTING

11.1 Harvest maturity

A growth period of 110 to 150 days is required for the crop to develop fully. Plants should be harvested when they turn yellow or wilt or when about 80 % of the pods have matured. Seeds are mature when the *parenchymatous* layer surrounding the embryo has disappeared and brown patches appear on the outside of the pod. Delay in harvesting is likely to lead to pod rot under humid and moist conditions.

11.2 Harvesting methods

Harvest the bambara groundnut by hand lifting and pulling the plant or the taproot can be cut, using a groundnut harvester or ploughed out or hoed out. The nuts are then pulled off the plant, dried and stored or eaten raw. Harvesting small plots is often done over a period of time. Bambara pods can break off very easily and up to half of the pods can remain in the soil, requiring collection by hand. Plants should be handled with care to reduce pod loss.

Part III: Post-harvest handling

1. SORTING

Usually seeds are sorted according to colour and size. The small seeds are consumed at household level while the bigger ones are for sale.

2. PACKING

After the plants have been cut, they are left for a day or two after which they can be stacked in wind rows to dry. The crop is ready for shelling when the pods rattle upon shaking. After drying, the pods are shelled by hand, using a flat stone or brick. On a large scale, groundnut shellers can be modified to handle the crop.

3. STORAGE

The crop is usually stored in shells. Shelling should take place only when the nuts are required for rations, sale or seed. Bambara nuts store well in the pods as the seed is extremely susceptible to weevil damage after shelling.

4. MARKETING

It was only in recent years that people started selling it in local markets like boiled groundnuts. Bambara is grown mainly by local people, mostly for home consumption while the surplus may be sold to individuals engaged in street sales at local markets. Seed size and colour are important factors in determining the marketing of the bambara. The bambara groundnut has not attained value on the international market yet.

Part IV: Utilisation

- Bambara groundnuts are essentially grown for human consumption and make a complete food.
- It can be eaten fresh or grilled while still immature.
- Seeds are pounded into flour and, used to make porridge with maize.
- Leaves can be used for animal feed after harvesting.

PRODUCTION SCHEDULE

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling												
Soil preparation												
Planting												
Fertilisation												
Irrigation												
Pest control												
Disease control												
Weed control												
Pruning												
Leaf sampling												
Harvesting												
Marketing												

REFERENCES

CHERIAN, M. 2012. *Bambara Groundnut (Vigna subterranean (L) Verdc)*. A publication of the Sub-directorate: Technology Development, Lowveld Research Unit, Department of Agriculture, Rural Development and Land Administration, Nelspruit

KAY, D.E. 1979. *Food Legumes. Crop and product digest, No. 3. Tropical Products Institute*, London (UK): 17-25.

LINNEMAN, A. R. 1987. *Bambara groundnut (Vigna subterranean (L) a review*. Abstract on Tropical Agriculture, 12 (7)

SWANEVELDER, J.C. (1998). *Bambara-food for Africa (Vigna subterranean - bambara groundnut) Production guidelines*. National Department of Agriculture, ARC - Grain Crops Institute, South Africa.

Further information can be obtained from
Directorate: Plant Production
Private Bag X 250
Pretoria, 0001
Tel: + 27 12 319 6072
Fax: +27 12 319 6372
E-mail: Thabo.Ramashala@daff.gov.za